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Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018389
Article Type:	Research
Date Submitted by the Author:	27-Jun-2017
Complete List of Authors:	Pigoga, Jennifer; University of Cape Town Department of Emergency Medicine Kafwamfwa, Muhumpu Cunningham, Charmaine; University of Cape Town, Division of Emergency Medicine Wallis, Lee; University of Cape Town, Surgery
Primary Subject Heading:	Emergency medicine
Secondary Subject Heading:	Medical education and training
Keywords:	MEDICAL EDUCATION & TRAINING, EMERGENCY CARE, EMERGENCY MEDICAL SERVICES, LAYPERSON RESPONSE

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Exploring the appropriateness of the Emergency First Aid
Responder curriculum in Zambia

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WORD COUNT: 3066

TABLE/FIGURE COUNT: 3

ABSTRACT

Objectives: The Emergency First Aid Responder (EFAR) programme is a layperson responder programme originally developed to help South Africans manage medical and traumatic emergencies at the community-level, pending arrival of formal care providers. At the request of local stakeholders, the South African EFAR programme was implemented in two rural regions of Zambia in 2015 without any changes made to the course curriculum. We undertook this study to evaluate the appropriateness of the existing Zambian EFAR curriculum, and to refine it for future use.

Design: Curriculum mapping and blueprinting methodologies were utilised to generate a refined EFAR curriculum. Data collected from patient run forms at an EFAR site, along with expert opinion, were utilised in this process.

Setting: This study was conducted based on data collected in Kasama, Zambia - a rural region of Zambia's Northern Province.

Results: A refined curriculum was generated that covers 54 topics (seven of which are new) and 25 practical skills (five new). When compared to the original EFAR curriculum, practical and didactic time devoted to general patient care and scene management was significantly increased, while time devoted to most other, clinical presentation-based categories (e.g. trauma care) was decreased.

Conclusions: Zambian EFARs encounter patients experiencing a wide range of emergencies, providing insight into the ideal EFAR course structure. The discrepancies noted between the original and refined curricula suggest that utilising an external curriculum without proper adaptation is not ideal for proper learning. Even with limited data and resources, curriculum mapping and blueprinting are appropriate means of resolving contextual issues.

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ARTICLE SUMMARY

- Layperson first response systems are cost-effective means of reducing morbidity and mortality due to acute illness and injury in LMICs.
- Curriculum mapping and blueprinting are practical methods of updating medical education programmes, even with limited resources.
- The translatability of this study’s results is limited, as data were only collected from a single site.
- These methods did not account for qualitative commentary data, which might have been useful in informing the final curriculum.
- The study highlights the need to tailor medical education curriculums to local context.

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INTRODUCTION

Emergency care encompasses a range of time-sensitive health services provided for acute medical, surgical, and obstetric conditions to avoid death or disability. Although well-embedded into the healthcare systems of many high-income countries, the establishment of emergency care in low- and middle- income countries (LMICs) remains an ongoing challenge, despite the central role it can play in the health system.¹⁻⁵ Even allowing for poor reporting mechanisms,⁶⁻⁸ it is clear that LMICs are burdened by the highest rates of injury and illness in nearly every category,⁹⁻¹³ and vulnerable populations within these nations are at particular risk.¹⁴⁻¹⁷ These emergencies come at high cost, directly affecting the psychosocial, health, productivity, and economic status of LMICs.^{4 18-24}

While regular and timely access to medical care should be of utmost importance in LMICs, numerous barriers, including rural living and negative financial implications, prevent this from occurring in a manner envisaged by the longitudinal primary care model.^{1 2 4} As a result, emergency care is the first point of contact with the health system for a great many people worldwide (including the poor and uninsured in high income countries). Emergency care systems have the potential to reduce deaths in LMICs by 54%;^{25 26} the prehospital component alone is also highly effective, reducing trauma mortality by up to 25%.²⁷

Prehospital emergency care systems modelled on those in high-income countries are unaffordable for most LMICs, which are in need of a less-expensive model.^{1 28} This model should be able to serve either as a foundation for prehospital care in areas where it does not exist, or as a support system to help newer prehospital care systems grow into maturity.²⁹ The Emergency First Aid Responder (EFAR) programme, which was developed in 2010 to meet the emergency care needs of low-resource areas in South Africa, meets these criteria.⁴ EFAR relies upon community involvement, on the basis that training a large number of community members will increase the likelihood that an EFAR is present or near to any emergency that may occur. Through community-specific trainings, EFARs are taught to provide life-saving care in the interim before ambulance arrival. Similar short courses geared towards layperson responders have proven effective in other LMICs.³⁰⁻³⁴

Zambia is a lower-middle-income Southern African nation of 16.2 million.³⁵ It may be considered a fairly typical African LMIC: although the country is urbanising, the majority of Zambians continue to live in rural areas and below the poverty line.³⁵ Maternal and infant mortality rates are high,³⁶ and the majority of premature deaths are preventable, stemming from injuries and infectious disease.³⁵ Emergency care systems in Zambia are insufficient, and there is no national ambulance service.³⁷ Most healthcare is public, provided collaboratively by the Zambian Ministry of Health and Zambian Defence Force, but the healthcare workforce remains inadequate.^{35 37} In order to improve emergency care, as the Zambian Ministry of Health and Zambian Defence Force have stated they wish to do, a multi-faceted approach must be taken. Providers must be trained and hospital care must be improved, but, in the meantime, Zambians must be empowered to handle emergencies on the community-level.³⁸

In a 2014 needs assessment, Zambians identified that a grassroots community response programme could facilitate the eventual formation of a strong and formal prehospital care system in their country.³⁹ Motivated by this, the Zambian Ministry of Health and Zambian Defence Force implemented the EFAR programme in 2015 in two rural villages: Kasama and Nyimba. The programme utilises community health centres to recruit participants and hold trainings.⁴⁰ These centres are staffed by the Zambian Defence Force, but serve both military personnel and the civilians in the region. There has since been concern that the Zambian EFAR curriculum – which was not modified from the original South African programme – was not a good fit for the emergency care needs of rural Zambian communities. The Zambian setting differs from the South African one in many ways: it is rural, less violent, has less existing infrastructure, and overall different culture and lifestyles. All of these factors are likely to influence the types of emergencies seen, and yet, an understanding of existing local resources and needs has

not been established. This study sought to utilise existing EFAR data to refine the Zambian EFAR curriculum for future implementations of the training programme.

METHODS

EFAR site data collection & analysis

Previous communications indicated that the EFAR patient run forms (PRFs) were being stored at Zambian Defence Force health centres where trainings were held. All EFAR-patient interactions logged between July 2015 and June 2016 were collected, retrospectively up until March 2016 and then prospectively. Data included patient demographics, presentations, and dispositions. No identifying information was collected. Data were entered into encrypted Microsoft Excel (© Microsoft, Richmond, WA) spreadsheets on-site. Basic and inferential statistics were generated using SAS 9.4 Software (© SAS, Cary, NC).

Curriculum refinement

Selecting an expert group

Successful curriculum refinement requires a group of experienced educators, topic opinion leaders, and medical professionals.⁴¹ The group may be as small as three members for a short learning experience, but should grow in size as the complexity of the learning experience increases.⁴¹ A group of five was deemed appropriate for this study. Reviewers were identified via email. All were physicians practicing emergency medicine. Reviewers were also required to have expertise in the Zambian context, the EFAR programme, and/or curriculum development.

Curriculum mapping

Curriculum mapping is a method of spatially representing the components of a curriculum that allows for identification of gaps and overlaps in course content.^{42 43} In the case of the EFAR curriculum, the purpose was to align the curricular elements with the emergency care needs of the regional population. The map alone did not yield a curriculum breakdown; however, it informed the blueprinting stage, wherein a weighted curriculum was developed. Curricular elements (the topics and skills covered in the course) were listed against chief complaints (extracted from PRFs) in Microsoft Excel. Chief complaints were then mapped to the existing EFAR curriculum by the lead researcher using a binary system. 1's related curricular elements that are relevant to the chief complaint. 0's were not believed to be pertinent to a chief complaint. The expert group reviewed the maps, validating or changing the curricular elements that corresponded to a particular complaint. For example, if a reviewer did not agree that the topic "headache" corresponded to the chief complaint of "hypo/hyperglycaemia" (as headache was mapped by the lead researcher), then the reviewer indicate this by changing the cell score from 1 to 0. Free text space was provided to add additional curricular elements (e.g., a topic not included in the curriculum but that the reviewer felt was important for handling the given complaint) and commentary. The individual reviewer sheets for topics and skills were compiled and summed. Scores ranged from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important). Where reviewers added additional curricular elements that related to a complaint, these were added to the compiled map and received a score of 1. The recorded number of times EFARs were presented with each chief complaint was also added into the compiled map, for ease of reference in the blueprinting stage.

Curriculum blueprinting

Curriculum blueprinting builds off the map, yielding a quantified distribution of curricular topics. The Coderre method was used in designing this portion of the analysis.⁴⁴ Informed reviewers were asked to ranked

curricular elements based on both impact and frequency (Table 1). Impact referred to usability in providing appropriate care for a patient presenting with a specific condition, while frequency related to how often the element might be used in practice. From these rankings, curricular elements can be weighted to give a breakdown of the curriculum in terms of time spent on each.

Table 1: Impact and frequency ranking definitions, adapted from *Coderre et al.*⁴⁴

Weight	Impact		Frequency	
Topic/skill is...	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)
1	Non-urgent	Little use in providing appropriate care	Rarely seen	Rarely utilised
2	Serious, but not immediately life threatening	Some use in providing care appropriate care	Relatively common	Occasionally utilised
3	Life threatening emergency	Extremely useful in providing care	Very common	Frequently utilised

The ranking sheets were compiled. A weighted score was calculated for each curricular element (Table 2), which represents the proportion of course time that educators should aim to spend on this curricular element. Topics correlate to didactic time, while skills correlate to practical (hands-on) time.

Table 2. An example of determining the relative weights of curricular elements.

Column # 1	2	3	4	5	6
Curriculum topic or skill	Mean Impact (I)	Mean Frequency (F)	IxF	$IxF/\sum(IxF)$	$[IxF/\sum(IxF)] \times 100$
Bandaging open wounds	2.6	2.5	6.5	0.06	6%

RESULTS

EFAR site data

Data availability

EFAR PRFs were available at the Kasama site. No PRFs were available at the Nyimba site.

Patient demographics

110 patients were seen by EFARs in Kasama from July 2015 to June 2016. Most (61, 56%) were male and adults (92, 84%; defined as over 11 years). The majority were brought to the Kasama Zambian Defence Force clinic (94, 86%). Nearly all patients (101, 92%) were referred to higher care.

Chief complaints

29 unique complaints were identified across medical and traumatic emergencies. When grouped based on aetiology, the most common complaint was known injury (39%), followed by respiratory problems (19%).

Curriculum mapping

Mapping yielded an additional seven topics and six skills, for a total of 54 topics and 26 skills. The results of curriculum mapping are available in online supplement S1 and S2.

Curriculum blueprinting

Mean impact scores for topics ranged from 0.5 (religion, culture, and tradition) to 3.0 (principles of first aid, airway, breathing, and unconsciousness). Mean frequency scores ranged from 0.33 (religion, culture, and tradition) to 3.0 (bleeding, fever, and dehydration). Product scores ranged from 0.17 (religion, culture, and tradition) to 8.40 (bleeding, fever, and dehydration). Topics were assigned between 0.4 and 86.7 minutes of course time.

Mean impact scores for skills ranged from 1.6 (for defibrillation and documentation) to 3.0 (opening and maintaining the airway). Mean frequency scores ranged from 0.75 (defibrillation) to 2.5 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Product scores ranged from 1.20 (defibrillation) to 6.50 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Skills were assigned between 4 and 21.6 minutes of course time.

The results of curriculum mapping are available in online supplements S3 and S4.

The refined EFAR curriculum

The original curriculum had six modules, into which each of the topics and skills for the refined curriculum were categorised for ease of comparison (Table 1).

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Table 3: Comparison of the modules included in the original and refined EFAR curricula.

Module	Content	Original curriculum				Refined curriculum			
		Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time	Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time
Environmental Emergencies	Bites and stings, electrocution, drowning & lightening	0.0	0.0	0.0	0.0	0.5	0.0	0.5	2.9
Unconsciousness & Near Unconsciousness	General altered mental status, hypoglycaemia & substance abuse	1.3	1.2	2.5	15.2	0.7	0.2	0.9	5.4
Obstetrics & Gynaecology	Cord prolapse, antepartum and postpartum haemorrhage & emergency delivery	2.0	1.1	3.1	18.9	0.1	0.2	0.3	1.9
Introduction & Scene Management	Overview of first aid, ethical aspects, scene assessment, primary and secondary patient assessments, mass casualty incidents & infection control	2.0	1.3	3.3	20.3	5.1	2.9	8.0	48.9
Medical Emergencies	Stroke, seizure, fever, dehydration, poisoning, breathing difficulty & shock	2.0	1.3	3.3	20.3	2.5	1.3	3.8	23.0
Injuries	Approach to patient with traumatic injuries	3.0	1.2	4.2	25.4	1.4	1.5	2.9	17.9
Course total		10.3	6.1	16.4	100.0	10.3	6.1	16.4	100.0

DISCUSSION

Significant changes were required for the Zambian EFAR programme to be contextually-relevant. Curriculum mapping and blueprinting were practical means of updating the programme, and are likely translatable to similar programmes in other LMIC settings.

The original and refined curriculums share only a single similarity across their six modules: medical emergencies. One module – introduction and scene management - saw a significant increase in time and three modules - obstetrics and gynaecology, unconsciousness and near unconsciousness, and injuries - were deemphasised in the final curriculum. The environmental emergencies module remained an insignificant portion of the curriculum. The medical emergencies module likely remained similar due to the burdens of infectious and non-communicable diseases being relatively similar between Zambia and South Africa.^{45 46}

Deemphasising the obstetric and injury sections was not predicted, given the well-documented burdens in Zambia.³⁵ Obstetric and gynaecologic emergencies, such as complicated delivery or post-partum haemorrhage, lead to high maternal mortality rates in Zambia,^{35 47} but they were not seen by EFARs in our study. The reasons behind this are unknown: it may suggest that existing systems to handle obstetric and gynaecologic emergencies in the Kasama region are inadequate, but could equally be due to EFARs feeling disempowered in such cases and therefore not responding. Similarly, injuries accounted for nearly 40% of EFAR complaints and reviewers are likely intimately aware of the local burden of injury.^{48 49} Trauma care reflected this, ranking consistently high in mapping and blueprinting. Yet, injury was deemphasised in the final curriculum. A likely explanation for this is that trauma care was actually overrepresented in the original EFAR curriculum due to the high burden of trauma in South Africa in comparison to Zambia.^{4 48 50 51} Further work is required to explore the mismatch in both fields.

Introduction and scene management saw a 242% increase in learning time. In the context of the EFAR programme’s main goal - training laypeople to handle the emergencies at a basic level - this result can be seen as successful. EFARs should be spending more time focusing on introductory material that will help them to handle a variety of emergencies. These results parallel other layperson responder programmes, which also place emphasis on broad skills that can aid patients presenting with a range of conditions.^{30 34} While environmental emergencies were included in the original curriculum, they were not included in the course programme that was implemented. Therefore, a before-and-after comparison could not be made, and the total time devoted in the original curriculum was denoted as zero. The percentage of total time in the refined curriculum is only around 3%, speaking to why it may not have been included in the first place: local and programmatic experts do not perceive it to be important.

We believe the refined curriculum will be effective in instructing Zambian EFARs, and in preparing them to manage the emergencies they are most likely to face. This study highlights that no two settings are the same: even between South Africa and Zambia, the course breakdown differs significantly. It is important to consider the context at the start, and to reconsider it at scheduled time intervals, as these LMIC regions are rapidly changing. A refinement process such as this should be used to ensure an appropriate and evolved curriculum is in place as any medical education programme expands.

The EFAR programme, and layperson first response systems in general, are cost effective means of reducing morbidity and mortality in LMICs.^{27 52} These short courses must train up people with minimal prior knowledge in a short span - typically one to five days.^{4 34} As such, course time must be maximised. Mapping and blueprinting can be leveraged to ensure that this occurs. Where

curriculums exist, it allows updating of the curriculum to ensure it is context-appropriate. Where no curriculum currently exists, programme developers might use these methods instead to generate an initial curriculum.

It has also proven challenging to identify methods that allow for translatability to other regions, while maintaining its low cost. There are few appropriate strategies for designing educational programmes in LMICs and training community members.⁵³ Current literature focuses on resource-heavy methods used in high-income countries, but these are unrealistic in LMICs. The curriculum refinement methods we describe are an efficient way of tailoring programmes to local needs, without heavy reliance on data collection and research personnel. Although the method has two stages, it is cost- and time-effective. Adaptations were easily made throughout the process as needed, from the size of the expert group to the definitions of impact and frequency for blueprinting.

Together, the EFAR model and curriculum refinement methods provide a flexible framework for development and expansion of layperson medical education programmes. These community-based programmes are vitally important to LMIC health systems development, and should be prioritised.

There are several limitations in this study. Based on original communications, we anticipated that data would be collected from two sites. One site did not have any data, and the second had significantly fewer PRFs available than predicted. The sample size was sufficient, but additional data would give a clearer picture of the types of complaints EFARs are presented with. It is not uncommon to be without sufficient data sets in LMICs,⁶⁻⁸ which supports the importance of utilising methods such as mapping and blueprinting that rely on minimal data in addition to other factors, such as expert knowledge.

The study only included quantitative data, and written commentary was not incorporated. Potentially useful and nuanced comments were not factored into the final weightings of the curriculum. In future iterations, developers should consider methodology that allows for the consideration of qualitative data in the final curriculum.

Results of the study are informing an improved curriculum, to be introduced in-country alongside improved monitoring and evaluation methods later in 2017. Ongoing data collection will allow for better assessment of the various EFAR sites and efficient curriculum refinement at scheduled time points in the future.

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ETHICAL CONSIDERATIONS

Ethical approval was obtained by the Human Research Ethics Committees at both the University of Cape Town and the University of Zambia.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

No additional data are available.

CONTRIBUTORSHIP

JLP, CC, and LAW conceived the study and contributed to its design. JLP carried out data collection and analysis, and drafted the manuscript. All authors contributed to the manuscript's revision and approved the final version for submission.

ACKNOWLEDGEMENTS

The research team would like to thank the expert review group for their efforts. We would also like to extend our gratitude to Dr Heike Geduld, without whose insight into curriculum development, this project would not have been possible.

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Online Supplement 1: Results of curriculum mapping for topics.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management			
	The need for first aid training	History of emergency care & Zambian first aid	Zambian healthcare levels & referral system	Definition of an emergency
Chest pain	5	5	1	5
Hypo/hyperglycaemia	5	5	1	5
Diarrhoea/constipation	5	5	1	5
Nausea/vomiting	5	5	1	5
Abdominal pain/distention	5	5	1	5
Suspected malaria	5	5	1	5
Intoxication	5	5	1	5
Loss of consciousness/fainting	5	5	1	5
Seizure/convulsion	5	5	1	5
Extremity pain	5	5	1	5
Asthma/wheezing	5	5	1	5
Cough	5	5	1	5
Difficulty in breathing	5	5	1	4
Foreign body airway obstruction	0	0	1	0
Dehydration	5	5	1	5
HIV complication	5	5	1	5
Suspected anaemia	5	5	1	5
Swelling	5	5	1	5
Bee sting	5	5	1	5
Back injury	5	5	1	5
Bleeding	5	5	1	5
Burn	5	5	1	5
Chest injury	5	5	1	5
Extremity injury	5	5	1	5
Head or neck injury	5	5	1	5
Injury (unspecified)	0	0	1	0
Open wound	0	0	1	0
Road traffic accident	0	0	1	0
Dislocation injury	0	0	1	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management (cont.)			
	Principles of first aid	Limitations of first aid	Responsibilities & aims	Qualities of first aid
Chest pain	5	5	5	5
Hypo/hyperglycaemia	5	5	5	5
Diarrhoea/constipation	5	5	5	5
Nausea/vomiting	5	5	5	5
Abdominal pain/distention	5	5	5	5
Suspected malaria	5	5	5	5
Intoxication	5	5	5	5
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	5	5
Cough	5	5	5	5
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	0	0	0	5
Dehydration	5	5	5	5
HIV complication	5	5	5	5
Suspected anaemia	5	5	5	5
Swelling	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding	5	5	5	5
Burn	5	5	5	5
Chest injury	5	5	5	5
Extremity injury	5	5	5	5
Head or neck injury	5	5	5	5
Injury (unspecified)	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Dislocation injury	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management (cont.)				
	Socrates & doing harm	Good Samaritan law/Legal protection of EFARs	Definition of negligence	Patient abandonment	Patient consent
Chest pain	5	5	5	5	5
Hypo/hyperglycaemia	5	5	5	5	5
Diarrhoea/constipation	5	5	5	5	5
Nausea/vomiting	5	5	5	5	5
Abdominal pain/distention	5	5	5	5	5
Suspected malaria	5	5	5	5	5
Intoxication	5	5	5	5	5
Loss of consciousness/fainting	5	5	5	5	5
Seizure/convulsion	5	5	5	5	5
Extremity pain	5	5	5	5	5
Asthma/wheezing	5	5	5	5	5
Cough	5	5	5	5	5
Difficulty in breathing	5	5	5	5	5
Foreign body airway obstruction	0	1	0	0	0
Dehydration	5	5	5	5	5
HIV complication	5	5	5	5	5
Suspected anaemia	5	5	5	5	5
Swelling	5	5	5	5	5
Bee sting	5	5	5	5	5
Back injury	5	5	5	5	5
Bleeding	5	5	5	5	5
Burn	5	5	5	5	5
Chest injury	5	5	5	5	5
Extremity injury	5	5	5	5	5
Head or neck injury	5	5	5	5	5
Injury (unspecified)	0	0	0	0	0
Open wound	0	0	0	0	0
Road traffic accident	0	0	0	0	0
Dislocation injury	0	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management (cont.)			
	Hospital hand-over	Police reporting	Documentation & reporting	Religion, culture & tradition
Chest pain	5	5	5	5
Hypo/hyperglycaemia	5	5	5	5
Diarrhoea/constipation	5	5	5	5
Nausea/vomiting	5	5	5	5
Abdominal pain/distention	5	5	5	5
Suspected malaria	5	5	5	5
Intoxication	5	5	5	5
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	5	5
Cough	5	5	5	5
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	0	0	0	0
Dehydration	5	5	5	5
HIV complication	5	5	5	5
Suspected anaemia	5	5	5	5
Swelling	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding	5	5	5	5
Burn	5	5	5	5
Chest injury	5	5	5	5
Extremity injury	5	5	5	5
Head or neck injury	5	5	5	5
Injury (unspecified)	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Dislocation injury	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management (cont.)		
	Calling for help	Scene size-up	Scene safety & PPE
Chest pain	5	5	5
Hypo/hyperglycaemia	5	5	5
Diarrhoea/constipation	5	5	5
Nausea/vomiting	5	5	5
Abdominal pain/distention	5	5	5
Suspected malaria	5	5	5
Intoxication	5	5	5
Loss of consciousness/fainting	5	5	5
Seizure/convulsion	5	5	5
Extremity pain	5	5	5
Asthma/wheezing	5	5	5
Cough	5	5	5
Difficulty in breathing	5	5	5
Foreign body airway obstruction	0	0	0
Dehydration	5	5	5
HIV complication	5	5	5
Suspected anaemia	5	5	5
Swelling	5	5	5
Bee sting	5	5	5
Back injury	5	5	5
Bleeding	5	5	5
Burn	5	5	5
Chest injury	5	5	5
Extremity injury	5	5	5
Head or neck injury	5	5	5
Injury (unspecified)	0	0	0
Open wound	0	0	0
Road traffic accident	0	0	0
Dislocation injury	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management (cont.)			
	Communication	Airway	Breathing	Circulation
Chest pain	5	5	5	5
Hypo/hyperglycaemia	5	5	5	5
Diarrhoea/constipation	5	5	5	5
Nausea/vomiting	5	5	5	5
Abdominal pain/distention	5	5	5	5
Suspected malaria	5	5	5	5
Intoxication	5	5	5	5
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	5	5
Cough	5	5	5	5
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	4	4	4	4
Dehydration	5	5	5	5
HIV complication	5	5	5	5
Suspected anaemia	5	5	5	5
Swelling	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding	5	5	5	5
Burn	5	5	5	5
Chest injury	5	5	5	5
Extremity injury	5	5	5	5
Head or neck injury	5	5	5	5
Injury (unspecified)	4	5	5	5
Open wound	5	5	0	0
Road traffic accident	5	5	0	5
Dislocation injury	5	5	5	5

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.

Topic	Introduction & Scene Management (cont.)			
	Disability & exposure	Reassessment	Infection prevention	MCIs ¹
Chest pain	5	5	0	1
Hypo/hyperglycaemia	4	5	0	1
Diarrhoea/constipation	5	5	1	1
Nausea/vomiting	4	5	1	1
Abdominal pain/distention	5	5	0	1
Suspected malaria	4	5	1	1
Intoxication	5	5	0	1
Loss of consciousness/fainting	4	5	0	1
Seizure/convulsion	5	5	0	1
Extremity pain	4	5	0	1
Asthma/wheezing	5	5	1	1
Cough	4	5	1	1
Difficulty in breathing	5	5	1	1
Foreign body airway obstruction	4	4	0	1
Dehydration	5	5	0	1
HIV complication	4	5	1	1
Suspected anaemia	5	5	1	1
Swelling	4	5	0	1
Bee sting	5	5	0	1
Back injury	4	5	0	1
Bleeding	5	5	1	1
Burn	4	5	0	1
Chest injury	5	5	0	1
Extremity injury	4	5	0	1
Head or neck injury	5	5	0	1
Injury (unspecified)	4	5	0	1
Open wound	0	5	1	1
Road traffic accident	4	5	0	1
Dislocation injury	4	5	1	1

¹ MCI: Mass casualty incident

Table 2: Results of curriculum mapping for the Injuries module.

Topic	Injuries					
	Approach to patient	First aid for common sports injuries	Head & spinal injuries	Bleeding	Fractures & soft tissue injuries	Burns
Chest pain	5	0	5	5	5	0
Hypo/hyperglycaemia	5	0	5	5	5	0
Diarrhoea/constipation	5	0	5	5	5	0
Nausea/vomiting	5	0	5	5	5	0
Abdominal pain/distention	5	0	5	5	5	0
Suspected malaria	5	0	5	5	5	0
Intoxication	5	0	5	5	5	0
Loss of consciousness/fainting	5	0	5	5	5	0
Seizure/convulsion	5	0	5	5	5	0
Extremity pain	5	0	5	5	5	0
Asthma/wheezing	5	0	5	5	5	0
Cough	5	0	5	5	5	0
Difficulty in breathing	5	0	5	5	5	0
Foreign body airway obstruction	4	0	4	4	4	0
Dehydration	5	0	5	5	5	0
HIV complication	5	0	5	5	5	0
Suspected anaemia	5	0	5	5	5	0
Swelling	5	0	5	5	5	0
Bee sting	5	0	5	5	5	0
Back injury	5	1	5	5	5	0
Bleeding	5	1	5	5	5	0
Burn	5	1	5	5	5	0
Chest injury	5	1	5	5	5	0
Extremity injury	5	1	5	5	5	0
Head or neck injury	5	1	5	5	5	0
Injury (unspecified)	5	1	5	5	5	0
Open wound	5	1	0	5	0	0
Road traffic accident	5	0	5	5	0	0
Dislocation injury	5	1	5	5	5	0

Table 3: Results of curriculum mapping for the Medical Emergencies module.

Topic	Medical Emergencies				
	Unconscious-ness	Stroke	Seizures	Fever	Hypo-glycaemia
Chest pain	0	0	0	0	0
Hypo/hyperglycaemia	5	2	5	0	5
Diarrhoea/constipation	0	0	0	5	0
Nausea/vomiting	0	1	0	5	0
Abdominal pain/distention	0	0	0	5	0
Suspected malaria	0	0	1	5	0
Intoxication	5	1	5	0	5
Loss of consciousness/fainting	5	5	5	1	5
Seizure/convulsion	5	2	5	5	5
Extremity pain	0	0	0	0	0
Asthma/wheezing	0	0	0	0	0
Cough	0	0	0	5	0
Difficulty in breathing	0	0	0	5	0
Foreign body airway obstruction	4	0	0	0	0
Dehydration	0	0	0	0	0
HIV complication	0	0	0	1	0
Suspected anaemia	0	0	0	0	0
Swelling	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding	5	0	0	0	0
Burn	0	0	0	0	0
Chest injury	0	0	0	0	0
Extremity injury	0	0	0	0	0
Head or neck injury	0	0	0	0	0
Injury (unspecified)	0	0	0	0	0
Open wound	0	0	0	0	0
Road traffic accident	1	0	0	1	1
Dislocation injury	0	0	0	0	0

Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module.

Topic	Medical Emergencies (cont.)				
	Dehydration	Drug & substance abuse & psychosis	Poisoning	Anaphylaxis	Difficulty breathing
Chest pain	0	0	0	0	1
Hypo/hyperglycaemia	0	0	0	0	0
Diarrhoea/constipation	5	1	1	0	0
Nausea/vomiting	5	1	1	0	0
Abdominal pain/distention	0	1	1	0	0
Suspected malaria	0	0	0	0	0
Intoxication	5	5	5	0	5
Loss of consciousness/fainting	5	1	1	0	5
Seizure/convulsion	5	0	1	0	5
Extremity pain	0	0	0	0	0
Asthma/wheezing	0	0	0	0	5
Cough	0	0	0	0	5
Difficulty in breathing	0	0	0	0	5
Foreign body airway obstruction	0	0	0	0	5
Dehydration	5	0	0	0	0
HIV complication	0	0	0	0	0
Suspected anaemia	0	0	0	0	1
Swelling	0	0	0	0	0
Bee sting	0	0	0	1	0
Back injury	0	0	0	0	0
Bleeding	4	0	0	0	0
Burn	5	0	0	0	0
Chest injury	0	0	0	0	1
Extremity injury	0	0	0	0	0
Head or neck injury	0	0	0	0	0
Injury (unspecified)	4	0	0	0	0
Open wound	4	0	0	0	0
Road traffic accident	4	0	0	0	1
Dislocation injury	4	0	0	0	0

Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module.

Topic	Medical Emergencies (cont.)				
	Headache	Chest pain	Abdominal pain	Extremity pain	Generalised pain
Chest pain	0	5	0	0	0
Hypo/hyperglycaemia	5	0	0	0	0
Diarrhoea/constipation	0	0	5	0	0
Nausea/vomiting	1	1	5	0	0
Abdominal pain/distention	0	0	5	0	0
Suspected malaria	5	0	0	0	0
Intoxication	5	0	5	0	0
Loss of consciousness/fainting	1	1	0	0	0
Seizure/convulsion	1	0	0	0	0
Extremity pain	0	0	0	5	5
Asthma/wheezing	0	5	0	0	0
Cough	0	5	0	0	0
Difficulty in breathing	0	5	0	0	0
Foreign body airway obstruction	0	0	0	0	0
Dehydration	1	0	5	0	0
HIV complication	0	0	0	0	0
Suspected anaemia	5	0	0	0	0
Swelling	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding	0	0	0	0	0
Burn	0	0	0	0	0
Chest injury	0	5	0	0	0
Extremity injury	0	0	0	0	0
Head or neck injury	5	0	0	0	0
Injury (unspecified)	1	1	1	0	0
Open wound	0	0	0	0	0
Road traffic accident	2	1	1	0	0
Dislocation injury	0	0	0	0	0

Table 4: Results of curriculum mapping for the Obstetrics & Gynaecology module.

Topic	Obstetric & Gynaecology
Chest pain	0
Hypo/hyperglycaemia	0
Diarrhoea/constipation	0
Nausea/vomiting	0
Abdominal pain/distention	3
Suspected malaria	0
Intoxication	0
Loss of consciousness/fainting	1
Seizure/convulsion	0
Extremity pain	0
Asthma/wheezing	0
Cough	0
Difficulty in breathing	0
Foreign body airway obstruction	0
Dehydration	0
HIV complication	0
Suspected anaemia	0
Swelling	0
Bee sting	0
Back injury	0
Bleeding	5
Burn	0
Chest injury	0
Extremity injury	0
Head or neck injury	0
Injury (unspecified)	0
Open wound	0
Road traffic accident	0
Dislocation injury	0

Table 5: Results of curriculum mapping for the Environmental Emergencies section.

Topic	Environmental Emergencies			
	Bites & stings	Electrocution	Lightning	Drowning
Chest pain	0	1	0	0
Hypo/hyperglycaemia	0	0	0	0
Diarrhoea/constipation	0	0	0	0
Nausea/vomiting	0	0	0	0
Abdominal pain/distention	0	0	0	0
Suspected malaria	0	0	0	0
Intoxication	0	0	0	0
Loss of consciousness/fainting	0	2	2	1
Seizure/convulsion	0	1	2	0
Extremity pain	1	0	1	0
Asthma/wheezing	1	0	0	0
Cough	0	0	0	0
Difficulty in breathing	2	0	0	3
Foreign body airway obstruction	0	0	0	0
Dehydration	0	0	0	0
HIV complication	0	0	0	0
Suspected anaemia	0	0	0	0
Swelling	2	0	0	0
Bee sting	5	0	0	0
Back injury	0	1	1	0
Bleeding	0	0	0	0
Burn	0	2	3	0
Chest injury	0	0	0	0
Extremity injury	0	0	0	0
Head or neck injury	0	1	1	0
Injury (unspecified)	0	1	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Dislocation injury	0	1	0	0

Online Supplement 2: Results of curriculum mapping for skills.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for bandaging, fracture stabilisation, BVM¹ use & C-spine stabilisation.

Skill	Bandaging open wounds	Basic fracture stabilisation	BVM use	C-spine stabilisation
Chest pain	0	0	0	0
Hypo/hyperglycaemia	0	0	0	0
Diarrhoea/constipation	4	4	0	0
Nausea/vomiting	0	0	0	0
Abdominal pain/distention	4	5	5	5
Suspected malaria	5	0	0	0
Intoxication	5	0	0	0
Loss of Consciousness/Fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	0	0
Cough	0	0	0	0
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	5	5	5	5
Other: dehydration	0	0	0	0
Other: HIV complication	5	5	5	5
Other: suspected anaemia	5	5	5	5
Swelling	0	0	0	0
Other: bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding	0	0	0	0
Burn	0	0	0	0
Chest injury	0	0	0	0
Extremity injury	0	0	0	0
Head or neck injury	0	0	0	0
Injury: unspecified	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Other: dislocation injury	0	0	0	0

¹ BVM: Bag-valve mask

Table 2: Results of curriculum mapping for calling for help, CPR², defibrillation & documentation.

Skill	Calling for help via mobile phone	CPR	Defibrillation	Documentation
Chest pain	0	0	0	0
Hypo/hyperglycaemia	0	0	0	0
Diarrhoea/constipation	4	4	0	0
Nausea/vomiting	0	0	0	0
Abdominal pain/distention	4	5	5	5
Suspected malaria	5	0	0	0
Intoxication	5	0	0	0
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	0	0
Cough	0	0	0	0
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	5	5	5	5
Other: dehydration	0	0	0	0
Other: HIV complication	5	5	5	5
Other: suspected anaemia	5	5	5	5
Swelling	0	0	0	0
Other: bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding	0	0	0	0
Burn	0	0	0	0
Chest injury	0	0	0	0
Extremity injury	0	0	0	0
Head or neck injury	0	0	0	0
Injury: unspecified	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Other: dislocation injury	0	0	0	0

² CPR: Cardiopulmonary resuscitation

Table 3: Results of curriculum mapping for first aid fundamentals, obtaining consent, airway maintenance & patient extrication.

Skill	Fundamentals of first aid	Obtaining consent	Opening/main taining airway	Patient extrication
Chest pain	0	0	0	0
Hypo/hyperglycaemia	0	0	0	0
Diarrhoea/constipation	4	4	0	0
Nausea/vomiting	0	0	0	0
Abdominal pain/distention	4	5	5	5
Suspected malaria	5	0	0	0
Intoxication	5	0	0	0
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	0	0
Cough	0	0	0	0
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	5	5	5	5
Other: dehydration	0	0	0	0
Other: HIV complication	5	5	5	5
Other: suspected anaemia	5	5	5	5
Swelling	0	0	0	0
Other: bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding	0	0	0	0
Burn	0	0	0	0
Chest injury	0	0	0	0
Extremity injury	0	0	0	0
Head or neck injury	0	0	0	0
Injury: unspecified	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Other: dislocation injury	0	0	0	0

Table 4: Results of curriculum mapping for patient transport, primary patient assessment, recovery position & scene size-up.

Skill	Patient transport	Primary patient assessment	Recovery position	Scene size-up
Chest pain	0	0	0	0
Hypo/hyperglycaemia	0	0	0	0
Diarrhoea/constipation	4	4	0	0
Nausea/vomiting	0	0	0	0
Abdominal pain/distention	4	5	5	5
Suspected malaria	5	0	0	0
Intoxication	5	0	0	0
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	0	0
Cough	0	0	0	0
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	5	5	5	5
Other: dehydration	0	0	0	0
Other: HIV complication	5	5	5	5
Other: suspected anaemia	5	5	5	5
Swelling	0	0	0	0
Other: bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding	0	0	0	0
Burn	0	0	0	0
Chest injury	0	0	0	0
Extremity injury	0	0	0	0
Head or neck injury	0	0	0	0
Injury: unspecified	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Other: dislocation injury	0	0	0	0

Table 5: Results of curriculum mapping for secondary patient assessment, trauma assessment, triage & PPE³ usage.

Skill	Secondary patient assessment	Trauma assessment	Triage	Using PPE
Chest pain	0	0	0	0
Hypo/hyperglycaemia	0	0	0	0
Diarrhoea/constipation	4	4	0	0
Nausea/vomiting	0	0	0	0
Abdominal pain/distention	4	5	5	5
Suspected malaria	5	0	0	0
Intoxication	5	0	0	0
Loss of consciousness/fainting	5	5	5	5
Seizure/convulsion	5	5	5	5
Extremity pain	5	5	5	5
Asthma/wheezing	5	5	0	0
Cough	0	0	0	0
Difficulty in breathing	5	5	5	5
Foreign body airway obstruction	5	5	5	5
Other: dehydration	0	0	0	0
Other: HIV complication	5	5	5	5
Other: suspected anaemia	5	5	5	5
Swelling	0	0	0	0
Other: bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding	0	0	0	0
Burn	0	0	0	0
Chest injury	0	0	0	0
Extremity injury	0	0	0	0
Head or neck injury	0	0	0	0
Injury: unspecified	0	0	0	0
Open wound	0	0	0	0
Road traffic accident	0	0	0	0
Other: dislocation injury	0	0	0	0

³ PPE: Personal protective equipment

Table 6: Results of curriculum mapping for glucometer use, delivery, malaria rapid testing, log rolling & pre-hospital ECG⁴ use.

Skill	Using a glucometer	Delivery	Malaria rapid test	Log rolling	Pre-hospital ECG
Chest pain	0	0	0	0	0
Hypo/hyperglycaemia	5	0	0	0	0
Diarrhoea/constipation	0	0	0	0	0
Nausea/vomiting	0	0	0	0	0
Abdominal pain/distention	0	0	0	0	0
Suspected malaria	0	0	1	0	0
Intoxication	0	0	0	0	0
Loss of consciousness/fainting	0	0	0	0	0
Seizure/convulsion	0	0	0	0	0
Extremity pain	0	0	0	0	0
Asthma/wheezing	0	0	0	0	0
Cough	0	0	0	0	0
Difficulty in breathing	0	0	0	0	0
Foreign body airway obstruction	0	0	0	0	0
Other: dehydration	0	0	0	0	0
Other: HIV complication	0	0	0	0	0
Other: suspected anaemia	0	0	0	0	0
Swelling	0	0	0	0	0
Other: bee sting	0	0	0	0	0
Back injury	0	0	0	1	0
Bleeding	0	0	0	1	0
Burn	0	0	0	1	0
Chest injury	0	0	0	1	0
Extremity injury	0	0	0	1	0
Head or neck injury	0	0	0	1	0
Injury: unspecified	0	0	0	1	0
Open wound	0	0	0	1	0
Road traffic accident	0	0	0	1	0
Other: dislocation injury	0	0	0	1	0

⁴ ECG: Electrocardiogram

Online Supplement 3: Results of curriculum blueprinting for topics and subtopics.

Curriculum topic(s)	Curriculum sub-topics	Impact	Frequency	I x F	Relative %	Weight	Section weight total
Introduction to emergency care	The need for first aid training	3.00	2.00	6.00	2.25	0.02	0.07
	History of emergency care & Zambian first aid	1.60	1.60	2.56	0.96	0.01	
	Zambian healthcare levels & referral system	2.40	1.80	4.32	1.62	0.02	
	Definition of an emergency	2.40	2.20	5.28	1.98	0.02	
Basic fundamentals of first aid	Principles of first aid	3.00	2.20	6.60	2.47	0.02	0.09
	Limitations of first aid	2.80	2.20	6.16	2.31	0.02	
	Responsibilities & aims	2.60	1.80	4.68	1.75	0.02	
	Qualities of first aid	2.60	2.20	5.72	2.14	0.02	
Medical-legal aspects of care	Socrates & doing harm	2.40	2.00	4.80	1.80	0.02	0.08
	Good Samaritan law/legal protection of EFARs ¹	2.40	2.00	4.80	1.80	0.02	
	Definition of negligence	2.00	1.40	2.80	1.05	0.01	
	Patient abandonment	2.00	1.80	3.60	1.35	0.01	
	Patient consent	2.20	2.00	4.40	1.65	0.02	
Procedures & implications of providing care	Hospital hand-over	2.00	1.40	2.80	1.05	0.01	0.02
	Police reporting	1.20	1.40	1.68	0.63	0.01	
	Documentation & reporting	1.40	1.40	1.96	0.73	0.01	
Religion, culture & tradition		0.50	0.33	0.17	0.06	0.00	0.00
Assessing the scene	Calling for help	2.60	2.40	6.24	2.34	0.02	0.06
	Scene size-up	2.60	2.00	5.20	1.95	0.02	
	Scene safety & PPE ²	2.60	2.00	5.20	1.95	0.02	
Patient primary assessment	Communication	2.40	2.00	4.80	1.80	0.02	0.09
	Airway	3.00	2.20	6.60	2.47	0.02	
	Breathing	3.00	2.20	6.60	2.47	0.02	

¹ EFAR: Emergency first aid responder² PPE: Personal protective equipment

	Circulation	2.80	2.20	6.16	2.31	0.02	
Patient secondary assessment	Disability & exposure	2.80	1.80	5.04	1.89	0.02	0.04
	Reassessment	2.40	2.60	6.24	2.34	0.02	
Trauma	Approach to patient	2.80	2.40	6.72	2.52	0.03	0.14
	First aid for common sports injuries	2.60	2.20	5.72	2.14	0.02	
	Head & spinal injuries	2.60	1.80	4.68	1.75	0.02	
	Bleeding	2.80	3.00	8.40	3.15	0.03	
	Fractures & soft tissue injuries	2.40	2.60	6.24	2.34	0.02	
	Burns	2.60	2.20	5.72	2.14	0.02	
Unconsciousness		3.00	2.60	7.80	2.92	0.03	0.03
Stroke		2.40	1.80	4.32	1.62	0.02	0.02
Seizures		2.80	2.40	6.72	2.52	0.03	0.03
Fever		2.80	3.00	8.40	3.15	0.03	0.03
Hypoglycaemia		2.80	2.60	7.28	2.73	0.03	0.03
Dehydration		2.80	3.00	8.40	3.15	0.03	0.03
Drug & substance abuse & psychosis		2.00	1.40	2.80	1.05	0.01	0.01
Poisoning		2.20	1.40	3.08	1.15	0.01	0.01
Anaphylaxis		2.60	1.40	3.64	1.36	0.01	0.01
Breathing difficulties		2.60	2.60	6.76	2.53	0.03	0.03
Severe pain	Headache	2.20	2.40	5.28	1.98	0.02	0.09
	Chest pain	2.60	2.20	5.72	2.14	0.02	
	Abdominal pain	2.60	2.40	6.24	2.34	0.02	
	Extremity pain	1.75	1.75	3.06	1.15	0.01	
	Generalised pain	1.80	1.60	2.88	1.08	0.01	
Obstetric & gynaecological emergencies		2.25	1.25	2.81	1.05	0.01	0.01
Environmental emergencies	Bites & stings	2.00	1.80	3.60	1.35	0.01	0.05
	Electrocution	2.60	1.20	3.12	1.17	0.01	
	Lightning	1.80	1.20	2.16	0.81	0.01	
	Drowning	2.40	1.40	3.36	1.26	0.01	
Mass casualty incidents		2.80	1.60	4.48	1.68	0.02	0.02
Infection prevention		2.80	2.60	7.28	2.73	0.03	0.03

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Online Supplement 4: Results of curriculum blueprinting for skills.

Skills	Impact	Frequency	I x F	Relative %	Weight
Defibrillation	1.60	0.75	1.20	1.09	0.01
Documentation	1.60	1.25	2.00	1.81	0.02
CPR ¹	2.20	1.00	2.20	2.00	0.02
Pre-hospital ECG ²	2.40	1.00	2.40	2.18	0.02
Malaria rapid test	1.80	1.50	2.70	2.45	0.02
BVM ³ use	2.40	1.25	3.00	2.72	0.03
Delivery	2.40	1.50	3.60	3.27	0.03
Using a glucometer	2.40	1.50	3.60	3.27	0.03
Obtaining consent	2.20	1.75	3.85	3.49	0.03
Secondary patient assessment	2.20	1.75	3.85	3.49	0.03
Log rolling	2.40	1.75	4.20	3.81	0.04
Using PPE ⁴	2.20	2.00	4.40	3.99	0.04
Patient extrication	2.60	1.75	4.55	4.13	0.04
Triage	2.60	1.75	4.55	4.13	0.04
Basic fracture stabilisation	2.40	2.00	4.80	4.35	0.04
C-spine stabilisation	2.80	1.75	4.90	4.44	0.04
Scene size-up	2.40	2.25	5.40	4.90	0.05
Fundamentals of first aid	2.80	2.00	5.60	5.08	0.05
Patient transport	2.80	2.00	5.60	5.08	0.05
Recovery position	2.60	2.25	5.85	5.31	0.05
Opening/maintaining airway	3.00	2.00	6.00	5.44	0.05
Bandaging open wounds	2.60	2.50	6.50	5.90	0.06
Calling for help via mobile phone	2.60	2.50	6.50	5.90	0.06
Primary patient assessment	2.60	2.50	6.50	5.90	0.06
Trauma assessment	2.60	2.50	6.50	5.90	0.06

¹ CPR: Cardiopulmonary resuscitation
² ECG: Electrocardiogram
³ BVM: Bag-valve mask
⁴ PPE: Personal protective equipment

BMJ Open

Exploring the appropriateness of the Emergency First Aid Responder course in Zambia through curriculum mapping and blueprinting

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018389.R1
Article Type:	Research
Date Submitted by the Author:	14-Sep-2017
Complete List of Authors:	Pigoga, Jennifer; University of Cape Town Department of Emergency Medicine Kafwamfwa, Muhumpu; Zambian Ministry of Health, Mobile & Emergency Health Services Cunningham, Charmaine; University of Cape Town, Division of Emergency Medicine Wallis, Lee; University of Cape Town, Surgery
Primary Subject Heading:	Emergency medicine
Secondary Subject Heading:	Medical education and training, Global health
Keywords:	MEDICAL EDUCATION & TRAINING, EMERGENCY CARE, EMERGENCY MEDICAL SERVICES, LAYPERSON RESPONSE

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Manuscripts

Exploring the appropriateness of the Emergency First Aid Responder course
in Zambia through curriculum mapping and blueprinting

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WORD COUNT: 3587

TABLE COUNT: 3

FIGURE COUNT: 0

NUMBER OF SUPPLEMENTARY FILES: 4

NUMBER OF REFERENCES: 53

ABSTRACT

Objectives: Community members are often the first to witness and respond to medical and traumatic emergencies, making them an essential first link to emergency care systems. The Emergency First Aid Responder (EFAR) programme is short course originally developed to help South Africans manage emergencies at the community-level, pending arrival of formal care providers. EFAR was implemented in two rural regions of Zambia in 2015, but no changes were made to tailor the course to the new setting. We undertook this study to evaluate the appropriateness of the Zambian EFAR curriculum, and to identify potential refinements.

Design: The EFAR curriculum was mapped against available chief complaint data. An expert group used information from the map, in tandem with personal knowledge, to rank each course topic for potential impact on patient outcomes and frequency of use in practice. Individual blueprints were compiled to generate a refined EFAR curriculum, the time breakdown of which reflects the relative weight of each topic.

Setting: This study was conducted based on data collected in Kasama, a rural region of Zambia's Northern Province.

Participants: An expert group of five physicians practicing emergency medicine was selected; all reviewers have expertise in the Zambian context, EFAR programme, and/or curriculum development.

Results: The range of emergencies that Zambian EFARs encounter indicates that the course must be broad in scope. The refined curriculum covers 54 topics (seven new) and 25 practical skills (five new). Practical and didactic time devoted to general patient care and scene management increased significantly, while time devoted to most other clinical, presentation-based categories (e.g. trauma care) decreased.

Conclusions: Discrepancies between original and refined curricula suggest that utilising an external curriculum without adaptation is not ideal for effective learning. Even with limited data and resources, curriculum mapping and blueprinting are possible means of resolving these contextual issues.

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ARTICLE SUMMARY

- The study highlights the importance of tailoring medical education curriculums to local context.
- It adds to a limited evidence base surrounding the refinement of medical education curriculums in LMICs.
- The curriculum mapping and blueprinting methodology presented in this study is likely useful in most low-resource settings.
- The translatability of the curriculum generated through this study is limited, as data were only collected from a single site in rural Zambia.
- These methods did not account for qualitative commentary data and community member input, which might have been useful in informing the final curriculum.

INTRODUCTION

Emergency care encompasses a range of time-sensitive health services provided for acute medical, surgical, and obstetric conditions to avoid death or disability. Although well-embedded into the healthcare systems of many high-income countries, the establishment of emergency care in low- and middle- income countries (LMICs) remains an ongoing challenge, despite the central role it can play in the health system.¹⁻⁵ Even allowing for poor reporting mechanisms,⁶⁻⁸ it is clear that LMICs are burdened by the highest rates of injury and illness in nearly every category,⁹⁻¹³ and vulnerable populations within these nations are at particular risk.¹⁴⁻¹⁷ These emergencies come at high cost, directly affecting the psychosocial, health, productivity, and economic status of LMICs.^{4 18-24}

While regular and timely access to medical care should be of utmost importance in LMICs, numerous barriers, including rural living and negative financial implications, prevent this from occurring in a manner envisaged by the longitudinal primary care model.^{1 2 4} As a result, emergency care is the first point of contact with the health system for a great many people worldwide (including the poor and uninsured in high-income countries). Emergency care systems have the potential to reduce deaths in LMICs by 54%;^{25 26} the prehospital component alone is also highly effective, reducing trauma-related mortality by up to 25%.²⁷

Prehospital emergency care systems modelled on those in high-income countries are unaffordable for most LMICs, which are in need of a less-expensive model.^{1 28} This model should be able to serve either as a foundation for prehospital care in areas where it does not exist, or as a support system to help newer prehospital care systems grow into maturity.²⁹ The Emergency First Aid Responder (EFAR) programme, which was developed in 2010 to meet the emergency care needs of low-resource areas in South Africa, satisfies these criteria.⁴ EFAR relies upon community involvement, on the basis that training a large number of community members will increase the likelihood that an EFAR is present or near to any emergency that may occur. Through community-specific trainings, EFARs are taught to provide life-saving care in the interim before ambulance arrival. Similar short courses geared towards layperson responders have proven effective in other LMICs.³⁰⁻³⁴

Zambia is a lower-middle-income Southern African nation of 16.2 million.³⁵ It may be considered a fairly typical African LMIC: although the country is urbanising, the majority of Zambians continue to live in rural areas and below the poverty line.³⁵ Maternal and infant mortality rates are high,³⁶ and the majority of premature deaths are preventable, stemming from injuries and infectious disease.³⁵ Emergency care systems in Zambia are insufficient, and there is no national ambulance service.³⁷ Most healthcare is public, provided collaboratively by the Zambian Ministry of Health and Zambian Defence Force, but the healthcare workforce remains inadequate.^{35 37} In order to improve emergency care, as the Zambian Ministry of Health and Zambian Defence Force have stated they wish to do, a multi-faceted approach needs to be taken. Providers must be trained and hospital care must be improved, but, in the meantime, Zambians must be empowered to handle emergencies on the community-level.³⁸

In a 2014 needs assessment, Zambians identified that a grassroots community response programme could facilitate the eventual formation of a strong and formal prehospital care system in their country.³⁹ Motivated by this, the Zambian Ministry of Health and Zambian Defence Force implemented the EFAR programme in 2015 in two rural villages: Kasama and Nyimba. The programme utilises community health centres to recruit participants and hold trainings.⁴⁰ These centres are staffed by the Zambian Defence Force, but serve both military personnel and the civilians in the region. There has since been concern that the Zambian EFAR curriculum – which was not modified from the original South African programme – was not a good fit for the emergency care needs of rural Zambian communities. The Zambian setting differs from the South African one in many ways: it is rural, less violent, has less existing infrastructure, and overall different culture and lifestyles. All of these factors are likely to influence the types of emergencies seen, and yet, existing local resources and needs have not been reflected in the EFAR curriculum.

Most educators focus primarily on adapting medical education curriculums as science surrounding course content evolves. But, secondarily, it is also necessary to tailor curriculums to local needs and resources. This is especially important in LMICs, where resource levels and health systems infrastructure can vary drastically

even within a region. Curriculum mapping is a method of spatially representing the components of a curriculum that allows for identification of gaps and overlaps in course content.^{41 42} Curriculum mapping has become well-accepted in the medical community in high-income countries as a means of keeping up with an ever-increasing knowledge base. It not only facilitates ongoing curricular evaluation, but also, rapid improvement and evolution,⁴³ and has been shown to improve educational outcomes.⁴²

In the case of the EFAR curriculum, the purpose of curriculum mapping was to align curricular elements (the topics and skills covered in the course) with the emergency care needs of the regional population. The map alone does not yield a weighted curriculum breakdown. Instead, it serves as a source of information for a second refinement process. Curriculum blueprinting, as defined by Coderre *et al.*, builds off the map, yielding a quantified distribution of curricular topics.⁴⁴ With expert input, curricular elements are weighted for both impact of learning the element as well as frequency with which the element is seen in the field. From the quantitative data that results, learning objectives and experiences can be revised.⁴⁴ These two methods – curriculum mapping and course blueprinting – have revolutionised the way in which modern medical education is planned, taught, and assessed. While commonplace in high-income countries, there is a little evidence surrounding the use of mapping and blueprinting in LMICs. An understanding of the importance of curriculum development has translated to some regions of sub-Saharan Africa, but implementing development methods has been noted as challenging in environments that already lack manpower and other resources.⁴⁵ We believe that curriculum mapping and blueprinting could be an effective means of refining course context and scope, thus positively impacting the development of medical education in LMICs.

This study sought to utilise existing EFAR data and expert input to evaluate the appropriateness of the current Zambian EFAR curriculum, and identify potential refinements for future use.

METHODS

EFAR site data collection & analysis

Previous communications indicated that the EFAR patient run forms (PRFs) were being stored at the two Zambian Defence Force health centres where trainings had been held. All EFAR-patient interactions logged between July 2015 and June 2016 were collected, retrospectively up until March 2016 and then prospectively. Data included patient demographics, chief complaints, presentations, and dispositions. No identifying information was collected. Data were entered into encrypted Microsoft Excel (© Microsoft, Richmond, WA) spreadsheets on-site. Basic statistics were generated using SAS 9.4 Software (© SAS, Cary, NC).

Curriculum refinement

Selecting an expert group

Conducting a successful curriculum refinement requires a group of experienced educators, topic opinion leaders, and medical professionals. The group may be as small as three members for a short learning experience, but should grow in size as the complexity of the learning experience increases.⁴⁶

A group of five was deemed appropriate for this study. Reviewers were identified via email. All were physicians practicing emergency medicine. Reviewers were also required to have expertise in the Zambian context, the EFAR programme, and/or curriculum development.

Curriculum mapping

The lead researcher generated two initial curriculum maps – one for course topics and another for skills - by mapping all curricular elements against all chief complaints (extracted from PRFs) in Microsoft Excel. Chief complaints were then matched to the existing EFAR curriculum by the lead researcher using a binary system. The relationship between each curricular element and chief complaint was directly explore. For example, the

topic “headache” was matched to “hypo/hyperglycaemia”, but it was not matched to “difficulty in breathing”. 1’s related curricular elements that are relevant to the chief complaint, such as “headache” to “hypo/hyperglycaemia”. 0’s were not believed to be pertinent to a chief complaint, such as “headache” to difficulty in breathing”.

The expert group reviewed the initial curriculum maps, validating or changing the curricular elements that corresponded to a particular complaint. Continuing with our example, if a reviewer did not agree that the topic “headache” corresponded to the chief complaint of “hypo/hyperglycaemia” (as headache was mapped by the lead researcher), then the reviewer indicate this by changing the cell score from 1 to 0. Free text space was provided to add additional curricular elements (e.g., a topic not included in the curriculum but that the reviewer felt was important for handling the given chief complaint) and other relevant commentary.

The individual reviewer sheets for topics and skills were compiled and summed (refer to online supplements S1 and S2). Scores ranged from 0 (none of the reviewers found the curricular element important in relation to the chief complaint) to 5 (all found it important). Where reviewers suggested additional curricular elements that related to a chief complaint, these were added to the compiled map and received a score of 1. The recorded number of times EFARs were presented with each chief complaint was also added into the compiled map, for ease of reference in the blueprinting stage.

Curriculum blueprinting

The two compiled maps were given to the expert review panel, to allow them to gain a sense of: 1. How relevant the group overall felt each topic or skill was in relation to the chief complaints and 2. How frequently chief complaints are seen in Kasama.

Informed reviewers were then asked to rank curricular elements. Reviewers called upon their personal knowledge and data from the maps to score each topic twice – once for impact, and a second time for frequency (Table 1). Impact referred to usability in providing appropriate care for a patient presenting with a specific condition, while frequency related to how often the element might be used in practice.

It should be noted that the definitions of impact and frequency vary slightly in relation to a curricular element that is a medical or traumatic condition (e.g. a traumatic injury) versus something that can be classified as general knowledge (e.g. the Good Samaritan law) or a skill (e.g. the method of scene size-up). For the former scenario, impact is ranked based on how frequently the skill might be used in treating a condition. A reviewer will likely consider a traumatic injury to be serious and perhaps life threatening, and thus, would rank it as a 2 or 3 for impact. Based on the frequency of chief complaints given in the curriculum map, traumatic injuries are common. A reviewer would then assign the frequency to a value of 3. General knowledge refers to topics that are not actually medical conditions, but rather, concepts that supplement an EFARs ability to treat the conditions themselves. An example of this would be the topics covered under medical-legal aspects of care. Knowledge of the Good Samaritan law might be of little use in the actual provision of appropriate care, but it might be utilised relatively often. Thus, it might rank a 1 on impact and a 2 on frequency. In the context of skills, the impact and frequency definitions are similar. A reviewer may think that the primary patient assessment is a skill that’s utilised in nearly every patient encounter, and thus assign it a 3 for frequency. The reviewer may also believe it to be extremely useful in providing care, yielding a 3 for impact. The ranking system is beneficial, as it is much more efficient to analyse quantitative data versus the alternative of qualitative commentary. From these rankings, curricular elements can be weighted to give a breakdown of the curriculum in terms of time spent on each.

Table 1: Impact and frequency ranking definitions, adapted from Coderre *et al.*⁴⁴

Weight	Impact		Frequency	
Topic/skill is...	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)
1	Non-urgent	Little use in providing appropriate care	Rarely seen	Rarely utilised
2	Serious, but not immediately life threatening	Some use in providing care appropriate care	Relatively common	Occasionally utilised
3	Life threatening emergency	Extremely useful in providing care	Very common	Frequently utilised

The ranking sheets were compiled. A weighted score was calculated for each curricular element (Table 2), which represents the proportion of course time that educators should aim to spend on this curricular element. Topics correlate to didactic time, while skills correlate to practical (hands-on) time.

Table 2: An example of determining the relative weights of curricular elements. Mean impacts and frequencies are tabulated across all reviewers for all curricular elements (columns 2 and 3). The products of these impacts and frequencies are calculated for each element (column 4). Then, the IxF for each individual element is divided by the sum of all of that elements’ IxF values (the total of column 4) to generate a relative weighting for each element (column 5). Column 6 represents this weight in percentage form. In this example, the skill of bandaging open wounds would take up 6% of practical course time.

Column # 1	2	3	4	5	6
Curriculum topic or skill	Mean Impact (I)	Mean Frequency (F)	IxF	IxF/Σ(IxF)	[IxF/Σ(IxF)]x 100
Bandaging open wounds	2.6	2.5	6.5	0.06	6%

RESULTS

EFAR site data

Data availability

EFAR PRFs were available at the Kasama site. No PRFs were available at the Nyimba site.

Patient demographics

110 patients were seen by EFARs in Kasama from July 2015 to June 2016. Most (61, 56%) were male and adults (92, 84%; defined as over 11 years). The majority were brought to the Kasama Zambian Defence Force clinic (94, 86%). Nearly all patients (101, 92%) were referred to higher care.

Chief complaints

29 unique complaints were identified across medical and traumatic emergencies. When grouped based on aetiology, the most common chief complaint was known injury (39%), followed by respiratory problems (19%).

Curriculum mapping

Mapping yielded an additional seven topics and six skills, for a total of 54 topics and 26 skills.

The results of curriculum mapping are available in online supplement S1 and S2.

Curriculum blueprinting

Mean impact scores for topics ranged from 0.5 (religion, culture, and tradition) to 3.0 (principles of first aid, airway, breathing, and unconsciousness). Mean frequency scores ranged from 0.33 (religion, culture, and tradition) to 3.0 (bleeding, fever, and dehydration). Product scores ranged from 0.17 (religion, culture, and tradition) to 8.40 (bleeding, fever, and dehydration). Topics were assigned between 0.4 and 86.7 minutes of course time.

Mean impact scores for skills ranged from 1.6 (for defibrillation and documentation) to 3.0 (opening and maintaining the airway). Mean frequency scores ranged from 0.75 (defibrillation) to 2.5 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Product scores ranged from 1.20 (defibrillation) to 6.50 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Skills were assigned between 4 and 21.6 minutes of course time.

The results of curriculum mapping are available in online supplements S3 and S4.

The refined EFAR curriculum

The original curriculum had six modules, into which each of the topics and skills for the refined curriculum were categorised for ease of comparison (Table 3).

Table 3: Comparison of the modules included in the original and refined EFAR curricula.

Module	Content	Original curriculum				Refined curriculum			
		Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time	Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time
Environmental Emergencies	Bites and stings, electrocution, drowning & lightening	0.0	0.0	0.0	0.0	0.5	0.0	0.5	2.9
Unconsciousness & Near Unconsciousness	General altered mental status, hypoglycaemia & substance abuse	1.3	1.2	2.5	15.2	0.7	0.2	0.9	5.4
Obstetrics & Gynaecology	Cord prolapse, antepartum and postpartum haemorrhage & emergency delivery	2.0	1.1	3.1	18.9	0.1	0.2	0.3	1.9
Introduction & Scene Management	Overview of first aid, ethical aspects, scene assessment, primary and secondary patient assessments, mass casualty incidents & infection control	2.0	1.3	3.3	20.3	5.1	2.9	8.0	48.9
Medical Emergencies	Stroke, seizure, fever, dehydration, poisoning, breathing difficulty & shock	2.0	1.3	3.3	20.3	2.5	1.3	3.8	23.0
Injuries	Approach to patient with traumatic injuries	3.0	1.2	4.2	25.4	1.4	1.5	2.9	17.9
Course total		10.3	6.1	16.4	100.0	10.3	6.1	16.4	100.0

DISCUSSION

Curriculum mapping and blueprinting were practical means of updating the programme and improving contextual relevancy, and are likely translatable to similar programmes in other LMIC settings.

Significant changes were required for the Zambian EFAR programme to be contextually-relevant. The original and refined curriculums share only a single similarity in distribution across their six modules: medical emergencies. One module – introduction and scene management – saw a significant increase in time and three modules – obstetrics and gynaecology, unconsciousness and near unconsciousness, and injuries – were deemphasised in the final curriculum. The environmental emergencies module remained an insignificant portion of the curriculum. The medical emergencies module likely remained similar due to the burdens of infectious and non-communicable diseases being relatively similar between Zambia and South Africa.^{47 48}

Deemphasising the obstetric and injury sections was not predicted, given the well-documented burdens in Zambia.³⁵ Obstetric and gynaecologic emergencies, such as complicated delivery or post-partum haemorrhage, lead to high maternal mortality rates in Zambia,^{35 49} but they were not seen by EFARs in our study. The reasons behind this are unknown: it may suggest that existing systems to handle obstetric and gynaecologic emergencies in the Kasama region are adequate, but could equally be due to EFARs feeling disempowered in such cases and therefore not responding. Similarly, injuries accounted for nearly 40% of EFAR chief complaints and reviewers are likely intimately aware of the local burden of injury.^{50 51} Trauma care reflected this, ranking consistently high in mapping and blueprinting. Yet, injury was deemphasised in the final curriculum. A likely explanation for this is that trauma care was actually overrepresented in the original EFAR curriculum due to the extremely large burden of trauma in South Africa in comparison to Zambia.^{4 50 52 53} Further work is required to explore the mismatch in both fields.

Introduction and scene management saw a 242% increase in learning time. In the context of the EFAR programme's main goal – training laypeople to handle the emergencies at a basic level – this result can be seen as successful. EFARs should be spending more time focusing on introductory material that will help them to handle a variety of emergencies. These results parallel other layperson responder programmes, which also place emphasis on broad skills that can aid patients presenting with a range of conditions.^{30 34} While environmental emergencies were included in the original curriculum, they were not included in the course programme that was implemented. Therefore, a before-and-after comparison could not be made, and the total time devoted in the original curriculum was denoted as zero. The percentage of total time in the refined curriculum is only around 3%, speaking to why it may not have been included in the first place: local and programmatic experts do not perceive it to be important.

We believe the refined curriculum will be effective in instructing Zambian EFARs, and in preparing them to manage the emergencies they are most likely to face. This study highlights that no two settings are the same: even between South Africa and Zambia, the course breakdown differs significantly. It is important to consider the context at the start, and to reconsider it at scheduled time intervals, as these LMIC regions are rapidly changing. A refinement process such as this should be used to ensure an appropriate and evolved curriculum is in place as any medical education programme expands.

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The EFAR programme, and layperson first response systems in general, are cost effective means of reducing morbidity and mortality in LMICs.^{27 54} These short courses must train up people with minimal prior knowledge in a short span - typically one to five days.^{4 34} As such, course time must be maximised. Mapping and blueprinting can be leveraged to ensure that this occurs. Where curriculums exist, it allows updating of the curriculum to ensure it is context-appropriate. Where no curriculum currently exists, programme developers might use these methods instead to generate an initial curriculum.

It has also proven challenging to identify methods that allow for adaption of programmes to other regions, while maintaining low cost. There are few appropriate strategies for designing educational programmes in LMICs and training community members.⁵⁵ Current literature focuses on resource-heavy methods used in high-income countries, but these are unrealistic in LMICs. The curriculum refinement methods we describe are an efficient way of tailoring programmes to local needs, without heavy reliance on data collection and research personnel. Although the method has two stages, it is cost- and time-effective. Adaptations were easily made throughout the process as needed, from the size of the expert group to the definitions of impact and frequency for blueprinting.

Together, the EFAR model and curriculum refinement methods provide a flexible framework for development and expansion of layperson medical education programmes. These community-based programmes are vitally important to LMIC health systems development, and should be prioritised.

There are several limitations in this study. Based on original communications, we anticipated that data would be collected from two sites. One site did not have any data, and the second had significantly fewer PRFs available than predicted. The sample size was sufficient, but additional data would give a clearer picture of the types of chief complaints EFARs are presented with. It is not uncommon to be without sufficient data sets in LMICs,⁶⁻⁸ which supports the importance of utilising methods such as mapping and blueprinting that rely on minimal data in addition to other factors, such as expert knowledge. While this limits transcaitvity of curriculum itself across other LMIC regions, it does not decrease limit translatability of our conclusion: curriculum mapping and blueprinting are practical methods of refining educational programmes to increase contextual relevancy.

The expert group that conducted curricular reviews was limited in size and nature. While the group included only physicians with significant knowledge about the Zambian context, community members and past EFAR trainees, who may have a different expectation of the scope of the EFAR course, were not engaged. Laypersons would likely need to be included in future studies through a simpler process, such as focus groups; however, current literature provides minimal guidance on how to incorporate this qualitative data into a weighted curriculum.

Additionally, the study only included quantitative data, and written commentary collected from reviewers was not incorporated. Potentially useful and nuanced comments were not factored into the final weightings of the curriculum. In future iterations, developers should consider methodology that allows for the consideration of various sources of qualitative data in generating the final curriculum.

Results of the study are informing an improved curriculum, to be introduced in-country alongside improved monitoring and evaluation methods later in 2017. Pedadogy for EFAR learners will be

1 explored during implementation, to ensure that the course content outline in the curriculum is
2 effectively reaching EFAR learners. Ongoing data collection will monitor learning retention, facilitate
3 assessment of EFAR sites, and allow efficient curriculum refinement at scheduled time points in the
4 future.

For peer review only

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ETHICAL CONSIDERATIONS

Ethical approval was obtained by the Human Research Ethics Committees at both the University of Cape Town and the University of Zambia.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

No additional data are available.

CONTRIBUTORSHIP

JLP, MK, CC, and LAW conceived the study and contributed to its design. JLP carried out data collection and analysis, and drafted the manuscript. All authors contributed to the manuscript's revision and approved the final version for submission.

ACKNOWLEDGEMENTS

The research team would like to thank the expert review group for their efforts. We would also like to extend our gratitude to Dr Heike Geduld, without whose insight into curriculum development, this project would not have been possible.

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Online Supplement 1: Results of curriculum mapping for topics.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for the Introduction & Scene Management module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management			
	The need for first aid training	History of emergency care & Zambian first aid	Zambian healthcare levels & referral system	Definition of an emergency
Chest pain (2)	5	5	1	5
Hypo/hyperglycaemia (5)	5	5	1	5
Diarrhoea/constipation (2)	5	5	1	5
Nausea/vomiting (1)	5	5	1	5
Abdominal pain/distention (1)	5	5	1	5
Suspected malaria (2)	5	5	1	5
Intoxication (2)	5	5	1	5
Loss of consciousness/fainting (3)	5	5	1	5
Seizure/convulsion (11)	5	5	1	5
Extremity pain (1)	5	5	1	5
Asthma/wheezing (9)	5	5	1	5
Cough (2)	5	5	1	5
Difficulty in breathing (2)	5	5	1	4
Foreign body airway obstruction (8)	0	0	1	0
Dehydration (5)	5	5	1	5
HIV complication (1)	5	5	1	5
Suspected anaemia (2)	5	5	1	5
Swelling (1)	5	5	1	5
Bee sting	5	5	1	5
Back injury	5	5	1	5
Bleeding (27)	5	5	1	5
Burn (1)	5	5	1	5
Chest injury	5	5	1	5
Extremity injury (2)	5	5	1	5
Head or neck injury (3)	5	5	1	5
Injury (unspecified) (3)	0	0	1	0
Open wound (2)	0	0	1	0
Road traffic accident (2)	0	0	1	0
Dislocation injury (1)	0	0	1	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Principles of first aid	Limitations of first aid	Responsibilities & aims	Qualities of first aid
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	0	0	0	5
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)				
	Socrates & doing harm	Good Samaritan law/Legal protection of EFARs	Definition of negligence	Patient abandonment	Patient consent
Chest pain (2)	5	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5	5
Nausea/vomiting (1)	5	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5	5
Suspected malaria (2)	5	5	5	5	5
Intoxication (2)	5	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5	5
Seizure/convulsion (11)	5	5	5	5	5
Extremity pain (1)	5	5	5	5	5
Asthma/wheezing (9)	5	5	5	5	5
Cough (2)	5	5	5	5	5
Difficulty in breathing (2)	5	5	5	5	5
Foreign body airway obstruction (8)	0	1	0	0	0
Dehydration (5)	5	5	5	5	5
HIV complication (1)	5	5	5	5	5
Suspected anaemia (2)	5	5	5	5	5
Swelling (1)	5	5	5	5	5
Bee sting	5	5	5	5	5
Back injury	5	5	5	5	5
Bleeding (27)	5	5	5	5	5
Burn (1)	5	5	5	5	5
Chest injury	5	5	5	5	5
Extremity injury (2)	5	5	5	5	5
Head or neck injury (3)	5	5	5	5	5
Injury (unspecified) (3)	0	0	0	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	0	0	0	0	0
Dislocation injury (1)	0	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Hospital hand-over	Police reporting	Documentation & reporting	Religion, culture & tradition
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	0	0	0	0
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)		
	Calling for help	Scene size-up	Scene safety & PPE
Chest pain (2)	5	5	5
Hypo/hyperglycaemia (5)	5	5	5
Diarrhoea/constipation (2)	5	5	5
Nausea/vomiting (1)	5	5	5
Abdominal pain/distention (1)	5	5	5
Suspected malaria (2)	5	5	5
Intoxication (2)	5	5	5
Loss of consciousness/fainting (3)	5	5	5
Seizure/convulsion (11)	5	5	5
Extremity pain (1)	5	5	5
Asthma/wheezing (9)	5	5	5
Cough (2)	5	5	5
Difficulty in breathing (2)	5	5	5
Foreign body airway obstruction (8)	0	0	0
Dehydration (5)	5	5	5
HIV complication (1)	5	5	5
Suspected anaemia (2)	5	5	5
Swelling (1)	5	5	5
Bee sting	5	5	5
Back injury	5	5	5
Bleeding (27)	5	5	5
Burn (1)	5	5	5
Chest injury	5	5	5
Extremity injury (2)	5	5	5
Head or neck injury (3)	5	5	5
Injury (unspecified) (3)	0	0	0
Open wound (2)	0	0	0
Road traffic accident (2)	0	0	0
Dislocation injury (1)	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Communication	Airway	Breathing	Circulation
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	4	4	4	4
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	4	5	5	5
Open wound (2)	5	5	0	0
Road traffic accident (2)	5	5	0	5
Dislocation injury (1)	5	5	5	5

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Disability & exposure	Reassessment	Infection prevention	MCIs ¹
Chest pain (2)	5	5	0	1
Hypo/hyperglycaemia (5)	4	5	0	1
Diarrhoea/constipation (2)	5	5	1	1
Nausea/vomiting (1)	4	5	1	1
Abdominal pain/distention (1)	5	5	0	1
Suspected malaria (2)	4	5	1	1
Intoxication (2)	5	5	0	1
Loss of consciousness/fainting (3)	4	5	0	1
Seizure/convulsion (11)	5	5	0	1
Extremity pain (1)	4	5	0	1
Asthma/wheezing (9)	5	5	1	1
Cough (2)	4	5	1	1
Difficulty in breathing (2)	5	5	1	1
Foreign body airway obstruction (8)	4	4	0	1
Dehydration (5)	5	5	0	1
HIV complication (1)	4	5	1	1
Suspected anaemia (2)	5	5	1	1
Swelling (1)	4	5	0	1
Bee sting	5	5	0	1
Back injury	4	5	0	1
Bleeding (27)	5	5	1	1
Burn (1)	4	5	0	1
Chest injury	5	5	0	1
Extremity injury (2)	4	5	0	1
Head or neck injury (3)	5	5	0	1
Injury (unspecified) (3)	4	5	0	1
Open wound (2)	0	5	1	1
Road traffic accident (2)	4	5	0	1
Dislocation injury (1)	4	5	1	1

¹ MCI: Mass casualty incident

Table 2: Results of curriculum mapping for the Injuries module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Injuries					
	Approach to patient	First aid for common sports injuries	Head & spinal injuries	Bleeding	Fractures & soft tissue injuries	Burns
Chest pain (2)	5	0	5	5	5	0
Hypo/hyperglycaemia (5)	5	0	5	5	5	0
Diarrhoea/constipation (2)	5	0	5	5	5	0
Nausea/vomiting (1)	5	0	5	5	5	0
Abdominal pain/distention (1)	5	0	5	5	5	0
Suspected malaria (2)	5	0	5	5	5	0
Intoxication (2)	5	0	5	5	5	0
Loss of consciousness/fainting (3)	5	0	5	5	5	0
Seizure/convulsion (11)	5	0	5	5	5	0
Extremity pain (1)	5	0	5	5	5	0
Asthma/wheezing (9)	5	0	5	5	5	0
Cough (2)	5	0	5	5	5	0
Difficulty in breathing (2)	5	0	5	5	5	0
Foreign body airway obstruction (8)	4	0	4	4	4	0
Dehydration (5)	5	0	5	5	5	0
HIV complication (1)	5	0	5	5	5	0
Suspected anaemia (2)	5	0	5	5	5	0
Swelling (1)	5	0	5	5	5	0
Bee sting	5	0	5	5	5	0
Back injury	5	1	5	5	5	0
Bleeding (27)	5	1	5	5	5	0
Burn (1)	5	1	5	5	5	0
Chest injury	5	1	5	5	5	0
Extremity injury (2)	5	1	5	5	5	0
Head or neck injury (3)	5	1	5	5	5	0
Injury (unspecified) (3)	5	1	5	5	5	0
Open wound (2)	5	1	0	5	0	0
Road traffic accident (2)	5	0	5	5	0	0
Dislocation injury (1)	5	1	5	5	5	0

Table 3: Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies				
	Unconscious- ness	Stroke	Seizures	Fever	Hypo- glycaemia
Chest pain (2)	0	0	0	0	0
Hypo/hyperglycaemia (5)	5	2	5	0	5
Diarrhoea/constipation (2)	0	0	0	5	0
Nausea/vomiting (1)	0	1	0	5	0
Abdominal pain/distention (1)	0	0	0	5	0
Suspected malaria (2)	0	0	1	5	0
Intoxication (2)	5	1	5	0	5
Loss of consciousness/fainting (3)	5	5	5	1	5
Seizure/convulsion (11)	5	2	5	5	5
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	0
Cough (2)	0	0	0	5	0
Difficulty in breathing (2)	0	0	0	5	0
Foreign body airway obstruction (8)	4	0	0	0	0
Dehydration (5)	0	0	0	0	0
HIV complication (1)	0	0	0	1	0
Suspected anaemia (2)	0	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding (27)	5	0	0	0	0
Burn (1)	0	0	0	0	0
Chest injury	0	0	0	0	0
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	0	0	0	0	0
Injury (unspecified) (3)	0	0	0	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	1	0	0	1	1
Dislocation injury (1)	0	0	0	0	0

Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies (cont.)				
	Dehydration	Drug & substance abuse & psychosis	Poisoning	Anaphylaxis	Difficulty breathing
Chest pain (2)	0	0	0	0	1
Hypo/hyperglycaemia (5)	0	0	0	0	0
Diarrhoea/constipation (2)	5	1	1	0	0
Nausea/vomiting (1)	5	1	1	0	0
Abdominal pain/distention (1)	0	1	1	0	0
Suspected malaria (2)	0	0	0	0	0
Intoxication (2)	5	5	5	0	5
Loss of consciousness/fainting (3)	5	1	1	0	5
Seizure/convulsion (11)	5	0	1	0	5
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	5
Cough (2)	0	0	0	0	5
Difficulty in breathing (2)	0	0	0	0	5
Foreign body airway obstruction (8)	0	0	0	0	5
Dehydration (5)	5	0	0	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	0	0	0	0	1
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	1	0
Back injury	0	0	0	0	0
Bleeding (27)	4	0	0	0	0
Burn (1)	5	0	0	0	0
Chest injury	0	0	0	0	1
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	0	0	0	0	0
Injury (unspecified) (3)	4	0	0	0	0
Open wound (2)	4	0	0	0	0
Road traffic accident (2)	4	0	0	0	1
Dislocation injury (1)	4	0	0	0	0

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Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies (cont.)				
	Headache	Chest pain	Abdominal pain	Extremity pain	Generalised pain
Chest pain (2)	0	5	0	0	0
Hypo/hyperglycaemia (5)	5	0	0	0	0
Diarrhoea/constipation (2)	0	0	5	0	0
Nausea/vomiting (1)	1	1	5	0	0
Abdominal pain/distention (1)	0	0	5	0	0
Suspected malaria (2)	5	0	0	0	0
Intoxication (2)	5	0	5	0	0
Loss of consciousness/fainting (3)	1	1	0	0	0
Seizure/convulsion (11)	1	0	0	0	0
Extremity pain (1)	0	0	0	5	5
Asthma/wheezing (9)	0	5	0	0	0
Cough (2)	0	5	0	0	0
Difficulty in breathing (2)	0	5	0	0	0
Foreign body airway obstruction (8)	0	0	0	0	0
Dehydration (5)	1	0	5	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	5	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding (27)	0	0	0	0	0
Burn (1)	0	0	0	0	0
Chest injury	0	5	0	0	0
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	5	0	0	0	0
Injury (unspecified) (3)	1	1	1	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	2	1	1	0	0
Dislocation injury (1)	0	0	0	0	0

Table 4: Results of curriculum mapping for the Obstetrics & Gynaecology module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Obstetric & Gynaecology
Chest pain (2)	0
Hypo/hyperglycaemia (5)	0
Diarrhoea/constipation (2)	0
Nausea/vomiting (1)	0
Abdominal pain/distention (1)	3
Suspected malaria (2)	0
Intoxication (2)	0
Loss of consciousness/fainting (3)	1
Seizure/convulsion (11)	0
Extremity pain (1)	0
Asthma/wheezing (9)	0
Cough (2)	0
Difficulty in breathing (2)	0
Foreign body airway obstruction (8)	0
Dehydration (5)	0
HIV complication (1)	0
Suspected anaemia (2)	0
Swelling (1)	0
Bee sting	0
Back injury	0
Bleeding (27)	5
Burn (1)	0
Chest injury	0
Extremity injury (2)	0
Head or neck injury (3)	0
Injury (unspecified) (3)	0
Open wound (2)	0
Road traffic accident (2)	0
Dislocation injury (1)	0

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Table 5: Results of curriculum mapping for the Environmental Emergencies section. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Environmental Emergencies			
	Bites & stings	Electrocution	Lightning	Drowning
Chest pain (2)	0	1	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	0	0	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	0	0	0	0
Suspected malaria (2)	0	0	0	0
Intoxication (2)	0	0	0	0
Loss of consciousness/fainting (3)	0	2	2	1
Seizure/convulsion (11)	0	1	2	0
Extremity pain (1)	1	0	1	0
Asthma/wheezing (9)	1	0	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	2	0	0	3
Foreign body airway obstruction (8)	0	0	0	0
Dehydration (5)	0	0	0	0
HIV complication (1)	0	0	0	0
Suspected anaemia (2)	0	0	0	0
Swelling (1)	2	0	0	0
Bee sting	5	0	0	0
Back injury	0	1	1	0
Bleeding (27)	0	0	0	0
Burn (1)	0	2	3	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	1	1	0
Injury (unspecified) (3)	0	1	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	1	0	0

Online Supplement 2: Results of curriculum mapping for skills.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for bandaging, fracture stabilisation, BVM¹ use & C-spine stabilisation.

Skill Chief complaint (n)	Bandaging open wounds	Basic fracture stabilisation	BVM use	C-spine stabilisation
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

¹ BVM: Bag-valve mask

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Table 2: Results of curriculum mapping for calling for help, CPR², defibrillation & documentation.

Skill Chief complaint (n)	Calling for help via mobile phone	CPR	Defibrillation	Documentation
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

² CPR: Cardiopulmonary resuscitation

Table 3: Results of curriculum mapping for first aid fundamentals, obtaining consent, airway maintenance & patient extrication.

Skill Chief complaint (n)	Fundamentals of first aid	Obtaining consent	Opening/maint aining airway	Patient extrication
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 4: Results of curriculum mapping for patient transport, primary patient assessment, recovery position & scene size-up.

Skill Chief complaint (n)	Patient transport	Primary patient assessment	Recovery position	Scene size-up
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 5: Results of curriculum mapping for secondary patient assessment, trauma assessment, triage & PPE³ usage.

Skill Chief complaint (n)	Secondary patient assessment	Trauma assessment	Triage	Using PPE
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

³ PPE: Personal protective equipment

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Table 6: Results of curriculum mapping for glucometer use, delivery, malaria rapid testing, log rolling & pre-hospital ECG⁴ use.

Skill Chief complaint (n)	Using a glucometer	Delivery	Malaria rapid test	Log rolling	Pre-hospital ECG
Chest pain (2)	0	0	0	0	0
Hypo/hyperglycaemia (5)	5	0	0	0	0
Diarrhoea/constipation (2)	0	0	0	0	0
Nausea/vomiting (1)	0	0	0	0	0
Abdominal pain/distention (1)	0	0	0	0	0
Suspected malaria (2)	0	0	1	0	0
Intoxication (2)	0	0	0	0	0
Loss of consciousness/fainting (3)	0	0	0	0	0
Seizure/convulsion (11)	0	0	0	0	0
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	0
Cough (2)	0	0	0	0	0
Difficulty in breathing (2)	0	0	0	0	0
Foreign body airway obstruction (8)	0	0	0	0	0
Dehydration (5)	0	0	0	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	0	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	1	0
Bleeding (27)	0	0	0	1	0
Burn (1)	0	0	0	1	0
Chest injury	0	0	0	1	0
Extremity injury (2)	0	0	0	1	0
Head or neck injury (3)	0	0	0	1	0
Injury (unspecified) (3)	0	0	0	1	0
Open wound (2)	0	0	0	1	0
Road traffic accident (2)	0	0	0	1	0
Dislocation injury (1)	0	0	0	1	0

⁴ ECG: Electrocardiogram

Online Supplement 3: Results of curriculum blueprinting for topics and subtopics.

Curriculum topic(s)	Curriculum sub-topics	Impact	Frequency	I x F	Relative %	Weight	Section weight total
Introduction to emergency care	The need for first aid training	3.00	2.00	6.00	2.25	0.02	0.07
	History of emergency care & Zambian first aid	1.60	1.60	2.56	0.96	0.01	
	Zambian healthcare levels & referral system	2.40	1.80	4.32	1.62	0.02	
	Definition of an emergency	2.40	2.20	5.28	1.98	0.02	
Basic fundamentals of first aid	Principles of first aid	3.00	2.20	6.60	2.47	0.02	0.09
	Limitations of first aid	2.80	2.20	6.16	2.31	0.02	
	Responsibilities & aims	2.60	1.80	4.68	1.75	0.02	
	Qualities of first aid	2.60	2.20	5.72	2.14	0.02	
Medical-legal aspects of care	Socrates & doing harm	2.40	2.00	4.80	1.80	0.02	0.08
	Good Samaritan law/legal protection of EFARs ¹	2.40	2.00	4.80	1.80	0.02	
	Definition of negligence	2.00	1.40	2.80	1.05	0.01	
	Patient abandonment	2.00	1.80	3.60	1.35	0.01	
	Patient consent	2.20	2.00	4.40	1.65	0.02	
Procedures & implications of providing care	Hospital hand-over	2.00	1.40	2.80	1.05	0.01	0.02
	Police reporting	1.20	1.40	1.68	0.63	0.01	
	Documentation & reporting	1.40	1.40	1.96	0.73	0.01	
Religion, culture & tradition		0.50	0.33	0.17	0.06	0.00	0.00
Assessing the scene	Calling for help	2.60	2.40	6.24	2.34	0.02	0.06
	Scene size-up	2.60	2.00	5.20	1.95	0.02	
	Scene safety & PPE ²	2.60	2.00	5.20	1.95	0.02	
Patient primary assessment	Communication	2.40	2.00	4.80	1.80	0.02	0.09
	Airway	3.00	2.20	6.60	2.47	0.02	
	Breathing	3.00	2.20	6.60	2.47	0.02	

¹ EFAR: Emergency first aid responder² PPE: Personal protective equipment

	Circulation	2.80	2.20	6.16	2.31	0.02	
Patient secondary assessment	Disability & exposure	2.80	1.80	5.04	1.89	0.02	0.04
	Reassessment	2.40	2.60	6.24	2.34	0.02	
Trauma	Approach to patient	2.80	2.40	6.72	2.52	0.03	0.14
	First aid for common sports injuries	2.60	2.20	5.72	2.14	0.02	
	Head & spinal injuries	2.60	1.80	4.68	1.75	0.02	
	Bleeding	2.80	3.00	8.40	3.15	0.03	
	Fractures & soft tissue injuries	2.40	2.60	6.24	2.34	0.02	
	Burns	2.60	2.20	5.72	2.14	0.02	
Unconsciousness		3.00	2.60	7.80	2.92	0.03	0.03
Stroke		2.40	1.80	4.32	1.62	0.02	0.02
Seizures		2.80	2.40	6.72	2.52	0.03	0.03
Fever		2.80	3.00	8.40	3.15	0.03	0.03
Hypoglycaemia		2.80	2.60	7.28	2.73	0.03	0.03
Dehydration		2.80	3.00	8.40	3.15	0.03	0.03
Drug & substance abuse & psychosis		2.00	1.40	2.80	1.05	0.01	0.01
Poisoning		2.20	1.40	3.08	1.15	0.01	0.01
Anaphylaxis		2.60	1.40	3.64	1.36	0.01	0.01
Breathing difficulties		2.60	2.60	6.76	2.53	0.03	0.03
Severe pain	Headache	2.20	2.40	5.28	1.98	0.02	0.09
	Chest pain	2.60	2.20	5.72	2.14	0.02	
	Abdominal pain	2.60	2.40	6.24	2.34	0.02	
	Extremity pain	1.75	1.75	3.06	1.15	0.01	
	Generalised pain	1.80	1.60	2.88	1.08	0.01	
Obstetric & gynaecological emergencies		2.25	1.25	2.81	1.05	0.01	0.01
Environmental emergencies	Bites & stings	2.00	1.80	3.60	1.35	0.01	0.05
	Electrocution	2.60	1.20	3.12	1.17	0.01	
	Lightning	1.80	1.20	2.16	0.81	0.01	
	Drowning	2.40	1.40	3.36	1.26	0.01	
Mass casualty incidents		2.80	1.60	4.48	1.68	0.02	0.02
Infection prevention		2.80	2.60	7.28	2.73	0.03	0.03

Online Supplement 4: Results of curriculum blueprinting for skills.

Skills	Impact	Frequency	I x F	Relative %	Weight
Defibrillation	1.60	0.75	1.20	1.09	0.01
Documentation	1.60	1.25	2.00	1.81	0.02
CPR ¹	2.20	1.00	2.20	2.00	0.02
Pre-hospital ECG ²	2.40	1.00	2.40	2.18	0.02
Malaria rapid test	1.80	1.50	2.70	2.45	0.02
BVM ³ use	2.40	1.25	3.00	2.72	0.03
Delivery	2.40	1.50	3.60	3.27	0.03
Using a glucometer	2.40	1.50	3.60	3.27	0.03
Obtaining consent	2.20	1.75	3.85	3.49	0.03
Secondary patient assessment	2.20	1.75	3.85	3.49	0.03
Log rolling	2.40	1.75	4.20	3.81	0.04
Using PPE ⁴	2.20	2.00	4.40	3.99	0.04
Patient extrication	2.60	1.75	4.55	4.13	0.04
Triage	2.60	1.75	4.55	4.13	0.04
Basic fracture stabilisation	2.40	2.00	4.80	4.35	0.04
C-spine stabilisation	2.80	1.75	4.90	4.44	0.04
Scene size-up	2.40	2.25	5.40	4.90	0.05
Fundamentals of first aid	2.80	2.00	5.60	5.08	0.05
Patient transport	2.80	2.00	5.60	5.08	0.05
Recovery position	2.60	2.25	5.85	5.31	0.05
Opening/maintaining airway	3.00	2.00	6.00	5.44	0.05
Bandaging open wounds	2.60	2.50	6.50	5.90	0.06
Calling for help via mobile phone	2.60	2.50	6.50	5.90	0.06
Primary patient assessment	2.60	2.50	6.50	5.90	0.06
Trauma assessment	2.60	2.50	6.50	5.90	0.06

¹ CPR: Cardiopulmonary resuscitation² ECG: Electrocardiogram³ BVM: Bag-valve mask⁴ PPE: Personal protective equipment

BMJ Open

Adapting the Emergency First Aid Responder course for Zambia through curriculum mapping and blueprinting

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018389.R2
Article Type:	Research
Date Submitted by the Author:	04-Oct-2017
Complete List of Authors:	Pigoga, Jennifer; University of Cape Town Department of Emergency Medicine Kafwamfwa, Muhumpu; Zambian Ministry of Health, Mobile & Emergency Health Services Cunningham, Charmaine; University of Cape Town, Division of Emergency Medicine Wallis, Lee; University of Cape Town, Surgery
Primary Subject Heading:	Emergency medicine
Secondary Subject Heading:	Medical education and training, Global health
Keywords:	MEDICAL EDUCATION & TRAINING, EMERGENCY CARE, EMERGENCY MEDICAL SERVICES, LAYPERSON RESPONSE

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**Adapting the Emergency First Aid Responder course
for Zambia through curriculum mapping and blueprinting**

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WORD COUNT: 3587

TABLE COUNT: 3

FIGURE COUNT: 0

NUMBER OF SUPPLEMENTARY FILES: 4

NUMBER OF REFERENCES: 53

ABSTRACT

Objectives: Community members are often the first to witness and respond to medical and traumatic emergencies, making them an essential first link to emergency care systems. The Emergency First Aid Responder (EFAR) programme is short course originally developed to help South Africans manage emergencies at the community-level, pending arrival of formal care providers. EFAR was implemented in two rural regions of Zambia in 2015, but no changes were made to tailor the course to the new setting. We undertook this study to identify potential refinements in the original EFAR curriculum, and to adapt it to the local context in Zambia.

Design: The EFAR curriculum was mapped against available chief complaint data. An expert group used information from the map, in tandem with personal knowledge, to rank each course topic for potential impact on patient outcomes and frequency of use in practice. Individual blueprints were compiled to generate a refined EFAR curriculum, the time breakdown of which reflects the relative weight of each topic.

Setting: This study was conducted based on data collected in Kasama, a rural region of Zambia's Northern Province.

Participants: An expert group of five physicians practicing emergency medicine was selected; all reviewers have expertise in the Zambian context, EFAR programme, and/or curriculum development.

Results: The range of emergencies that Zambian EFARs encounter indicates that the course must be broad in scope. The refined curriculum covers 54 topics (seven new) and 25 practical skills (five new). Practical and didactic time devoted to general patient care and scene management increased significantly, while time devoted to most other clinical, presentation-based categories (e.g. trauma care) decreased.

Conclusions: Discrepancies between original and refined curricula highlight a mismatch between the external curriculum and local context. Even with limited data and resources, curriculum mapping and blueprinting are possible means of resolving these contextual issues.

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ARTICLE SUMMARY

- The study highlights the importance of tailoring medical education curriculums to local context.
- It adds to a limited evidence base surrounding the refinement of medical education curriculums in LMICs.
- The curriculum mapping and blueprinting methodology presented in this study is likely useful in most low-resource settings.
- The translatability of the curriculum generated through this study is limited, as data were only collected from a single site in rural Zambia.
- These methods did not account for qualitative commentary data and community member input, which might have been useful in informing the final curriculum.

INTRODUCTION

Emergency care encompasses a range of time-sensitive health services provided for acute medical, surgical, and obstetric conditions to avoid death or disability. Although well-embedded into the healthcare systems of many high-income countries, the establishment of emergency care in low- and middle- income countries (LMICs) remains an ongoing challenge, despite the central role it can play in the health system.¹⁻⁵ Even allowing for poor reporting mechanisms,⁶⁻⁸ it is clear that LMICs are burdened by the highest rates of injury and illness in nearly every category,⁹⁻¹³ and vulnerable populations within these nations are at particular risk.¹⁴⁻¹⁷ These emergencies come at high cost, directly affecting the psychosocial, health, productivity, and economic status of LMICs.^{4 18-24}

While regular and timely access to medical care should be of utmost importance in LMICs, numerous barriers, including rural living and negative financial implications, prevent this from occurring in a manner envisaged by the longitudinal primary care model.^{1 2 4} As a result, emergency care is the first point of contact with the health system for a great many people worldwide (including the poor and uninsured in high-income countries). Emergency care systems have the potential to reduce deaths in LMICs by 54%;^{25 26} the prehospital component alone is also highly effective, reducing trauma-related mortality by up to 25%.²⁷

Prehospital emergency care systems modelled on those in high-income countries are unaffordable for most LMICs, which are in need of a less-expensive model.^{1 28} This model should be able to serve either as a foundation for prehospital care in areas where it does not exist, or as a support system to help newer prehospital care systems grow into maturity.²⁹ The Emergency First Aid Responder (EFAR) programme, which was developed in 2010 to meet the emergency care needs of low-resource areas in South Africa, satisfies these criteria.⁴ EFAR relies upon community involvement, on the basis that training a large number of community members will increase the likelihood that an EFAR is present or near to any emergency that may occur. Through community-specific trainings, EFARs are taught to provide life-saving care in the interim before ambulance arrival. Similar short courses geared towards layperson responders have proven effective in other LMICs.³⁰⁻³⁴

Zambia is a lower-middle-income Southern African nation of 16.2 million.³⁵ It may be considered a fairly typical African LMIC: although the country is urbanising, the majority of Zambians continue to live in rural areas and below the poverty line.³⁵ Maternal and infant mortality rates are high,³⁶ and the majority of premature deaths are preventable, stemming from injuries and infectious disease.³⁵ Emergency care systems in Zambia are insufficient, and there is no national ambulance service.³⁷ Most healthcare is public, provided collaboratively by the Zambian Ministry of Health and Zambian Defence Force, but the healthcare workforce remains inadequate.^{35 37} In order to improve emergency care, as the Zambian Ministry of Health and Zambian Defence Force have stated they wish to do, a multi-faceted approach needs to be taken. Providers must be trained and hospital care must be improved, but, in the meantime, Zambians must be empowered to handle emergencies on the community-level.³⁸

In a 2014 needs assessment, Zambians identified that a grassroots community response programme could facilitate the eventual formation of a strong and formal prehospital care system in their country.³⁹ Motivated by this, the Zambian Ministry of Health and Zambian Defence Force implemented the EFAR programme in 2015 in two rural villages: Kasama and Nyimba. The programme utilises community health centres to recruit participants and hold trainings.⁴⁰ These centres are staffed by the Zambian Defence Force, but serve both military personnel and the civilians in the region. There has since been concern that the Zambian EFAR curriculum – which was not modified from the original South African programme – was not a good fit for the emergency care needs of rural Zambian communities. The Zambian setting differs from the South African one in many ways: it is rural, less violent, has less existing infrastructure, and overall different culture and lifestyles. All of these factors are likely to influence the types of emergencies seen, and yet, existing local resources and needs have not been reflected in the EFAR curriculum.

Most educators focus primarily on adapting medical education curriculums as science surrounding course content evolves. But, secondarily, it is also necessary to tailor curriculums to local needs and resources. This is especially important in LMICs, where resource levels and health systems infrastructure can vary drastically

even within a region. Curriculum mapping is a method of spatially representing the components of a curriculum that allows for identification of gaps and overlaps in course content.^{41 42} Curriculum mapping has become well-accepted in the medical community in high-income countries as a means of keeping up with an ever-increasing knowledge base. It not only facilitates ongoing curricular evaluation, but also, rapid improvement and evolution,⁴³ and has been shown to improve educational outcomes.⁴²

In the case of the EFAR curriculum, the purpose of curriculum mapping was to align curricular elements (the topics and skills covered in the course) with the emergency care needs of the regional population. The map alone does not yield a weighted curriculum breakdown. Instead, it serves as a source of information for a second refinement process. Curriculum blueprinting, as defined by Coderre *et al.*, builds off the map, yielding a quantified distribution of curricular topics.⁴⁴ With expert input, curricular elements are weighted for both impact of learning the element as well as frequency with which the element is seen in the field. From the quantitative data that results, learning objectives and experiences can be revised.⁴⁴ These two methods – curriculum mapping and course blueprinting – have revolutionised the way in which modern medical education is planned, taught, and assessed. While commonplace in high-income countries, there is a little evidence surrounding the use of mapping and blueprinting in LMICs. An understanding of the importance of curriculum development has translated to some regions of sub-Saharan Africa, but implementing development methods has been noted as challenging in environments that already lack manpower and other resources.⁴⁵ We believe that curriculum mapping and blueprinting could be an effective means of refining course context and scope, thus positively impacting the development of medical education in LMICs.

This study sought to utilise existing EFAR data and expert input to identify potential refinements and adapt the EFAR curriculum to Zambia.

METHODS

EFAR site data collection & analysis

Previous communications indicated that the EFAR patient run forms (PRFs) were being stored at the two Zambian Defence Force health centres where trainings had been held. All EFAR-patient interactions logged between July 2015 and June 2016 were collected, retrospectively up until March 2016 and then prospectively. Data included patient demographics, chief complaints, presentations, and dispositions. No identifying information was collected. Data were entered into encrypted Microsoft Excel (© Microsoft, Richmond, WA) spreadsheets on-site. Basic statistics were generated using SAS 9.4 Software (© SAS, Cary, NC).

Curriculum refinement

Selecting an expert group

Conducting a successful curriculum refinement requires a group of experienced educators, topic opinion leaders, and medical professionals. The group may be as small as three members for a short learning experience, but should grow in size as the complexity of the learning experience increases.⁴⁶

A group of five was deemed appropriate for this study. Reviewers were identified via email. All were physicians practicing emergency medicine. Reviewers were also required to have expertise in the Zambian context, the EFAR programme, and/or curriculum development.

Curriculum mapping

The lead researcher generated two initial curriculum maps – one for course topics and another for skills - by mapping all curricular elements against all chief complaints (extracted from PRFs) in Microsoft Excel. Chief complaints were then matched to the existing EFAR curriculum by the lead researcher using a binary system. The relationship between each curricular element and chief complaint was directly explored. For example,

the topic “headache” was matched to “hypo/hyperglycaemia”, but it was not matched to “difficulty in breathing”. 1’s related curricular elements that are relevant to the chief complaint, such as “headache” to “hypo/hyperglycaemia”. 0’s were not believed to be pertinent to a chief complaint, such as “headache” to difficulty in breathing”.

The expert group reviewed the initial curriculum maps, validating or changing the curricular elements that corresponded to a particular complaint. Continuing with our example, if a reviewer did not agree that the topic “headache” corresponded to the chief complaint of “hypo/hyperglycaemia” (as headache was mapped by the lead researcher), then the reviewer indicated this by changing the cell score from 1 to 0. Free text space was provided to add additional curricular elements (e.g., a topic not included in the curriculum but that the reviewer felt was important for handling the given chief complaint) and other relevant commentary.

The individual reviewer sheets for topics and skills were compiled and summed (refer to online supplements S1 and S2). Scores ranged from 0 (none of the reviewers found the curricular element important in relation to the chief complaint) to 5 (all found it important). Where reviewers suggested additional curricular elements that related to a chief complaint, these were added to the compiled map and received a score of 1. The recorded number of times EFARs were presented with each chief complaint was also added to the compiled map, for ease of reference in the blueprinting stage.

Curriculum blueprinting

The two compiled maps were given to the expert review panel, to allow them to gain a sense of: 1. How relevant the group overall felt each topic or skill was in relation to the chief complaints and 2. How frequently chief complaints are seen in Kasama.

Informed reviewers were then asked to rank curricular elements. Reviewers called upon their personal knowledge and data from the maps to score each topic twice – once for impact, and a second time for frequency (Table 1). Impact referred to usability in providing appropriate care for a patient presenting with a specific condition, while frequency related to how often the element might be used in practice. Both impact and frequency were given a rank between 1 and 3, with 1 being the least important/frequent and 3 being the most important/frequent.

It should be noted that the definitions of impact and frequency vary slightly in relation to a curricular element that is a medical or traumatic condition (e.g. a traumatic injury) versus something that can be classified as general knowledge (e.g. the Good Samaritan law) or a skill (e.g. the method of scene size-up). For the former scenario, impact is ranked based on how frequently the skill might be used in treating a condition. A reviewer will likely consider a traumatic injury to be serious and perhaps life threatening, and thus, would rank it as a 2 or 3 for impact. Based on the frequency of chief complaints given in the curriculum map, traumatic injuries are common. A reviewer would then assign the frequency to a value of 3. General knowledge refers to topics that are not actually medical conditions, but rather, concepts that supplement an EFARs ability to treat the conditions themselves. An example of this would be the topics covered under medical-legal aspects of care. Knowledge of the Good Samaritan law might be of little use in the actual provision of appropriate care, but it might be utilised relatively often. Thus, it might rank a 1 on impact and a 2 on frequency. In the context of skills, the impact and frequency definitions are similar. A reviewer may think that the primary patient assessment is a skill that’s utilised in nearly every patient encounter, and thus assign it a 3 for frequency. The reviewer may also believe it to be extremely useful in providing care, yielding a 3 for impact. The ranking system is beneficial, as it is much more efficient to analyse quantitative data versus the alternative of qualitative commentary. From these rankings, curricular elements can be weighted to give a breakdown of the curriculum in terms of time spent on each.

Table 1: Impact and frequency ranking definitions, adapted from Coderre et al.⁴⁴

Weight	Impact		Frequency	
Topic/skill is...	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)
1	Non-urgent	Little use in providing appropriate care	Rarely seen	Rarely utilised
2	Serious, but not immediately life threatening	Some use in providing care appropriate care	Relatively common	Occasionally utilised
3	Life threatening emergency	Extremely useful in providing care	Very common	Frequently utilised

The ranking sheets were compiled. A weighted score was calculated for each curricular element (Table 2), which represents the proportion of course time that educators should aim to spend on this curricular element. Topics correlate to didactic time, while skills correlate to practical (hands-on) time.

Table 2: An example of determining the relative weights of curricular elements. Mean impacts and frequencies are tabulated across all reviewers for all curricular elements (columns 2 and 3). The products of these impacts and frequencies are calculated for each element (column 4). Then, the IxF for each individual element is divided by the sum of all of that elements' IxF values (the total of column 4) to generate a relative weighting for each element (column 5). Column 6 represents this weight in percentage form. In this example, the skill of bandaging open wounds would take up 6% of practical course time.

Column # 1	2	3	4	5	6
Curriculum topic or skill	Mean Impact (I)	Mean Frequency (F)	IxF	$IxF/\sum(IxF)$	$[IxF/\sum(IxF)] \times 100$
Bandaging open wounds	2.6	2.5	6.5	0.06	6%

RESULTS

EFAR site data

Data availability

EFAR PRFs were available at the Kasama site. No PRFs were available at the Nyimba site.

Patient demographics

110 patients were seen by EFARs in Kasama from July 2015 to June 2016. Most (61, 56%) were male and adults (92, 84%; defined as over 11 years). The majority were brought to the Kasama Zambia Defence Force clinic (94, 86%). Nearly all patients (101, 92%) were referred to higher care.

Chief complaints

29 unique complaints were identified across medical and traumatic emergencies. When grouped based on aetiology, the most common chief complaint was known injury (39%), followed by respiratory problems (19%).

Curriculum mapping

Mapping yielded an additional seven topics and six skills, for a total of 54 topics and 26 skills.

The results of curriculum mapping are available in online supplement S1 and S2.

Curriculum blueprinting

Mean impact scores for topics ranged from 0.5 (religion, culture, and tradition) to 3.0 (principles of first aid, airway, breathing, and unconsciousness). Mean frequency scores ranged from 0.33 (religion, culture, and tradition) to 3.0 (bleeding, fever, and dehydration). Product scores ranged from 0.17 (religion, culture, and tradition) to 8.40 (bleeding, fever, and dehydration). Topics were assigned between 0.4 and 86.7 minutes of course time.

Mean impact scores for skills ranged from 1.6 (for defibrillation and documentation) to 3.0 (opening and maintaining the airway). Mean frequency scores ranged from 0.75 (defibrillation) to 2.5 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Product scores ranged from 1.20 (defibrillation) to 6.50 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Skills were assigned between 4 and 21.6 minutes of course time.

The results of curriculum mapping are available in online supplements S3 and S4.

The refined EFAR curriculum

The original curriculum had six modules, into which each of the topics and skills for the refined curriculum were categorised for ease of comparison (Table 3).

Table 3: Comparison of the modules included in the original and refined EFAR curricula.

Module	Content	Original curriculum				Refined curriculum			
		Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time	Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time
Environmental Emergencies	Bites and stings, electrocution, drowning & lightening	0.0	0.0	0.0	0.0	0.5	0.0	0.5	2.9
Unconsciousness & Near Unconsciousness	General altered mental status, hypoglycaemia & substance abuse	1.3	1.2	2.5	15.2	0.7	0.2	0.9	5.4
Obstetrics & Gynaecology	Cord prolapse, antepartum and postpartum haemorrhage & emergency delivery	2.0	1.1	3.1	18.9	0.1	0.2	0.3	1.9
Introduction & Scene Management	Overview of first aid, ethical aspects, scene assessment, primary and secondary patient assessments, mass casualty incidents & infection control	2.0	1.3	3.3	20.3	5.1	2.9	8.0	48.9
Medical Emergencies	Stroke, seizure, fever, dehydration, poisoning, breathing difficulty & shock	2.0	1.3	3.3	20.3	2.5	1.3	3.8	23.0
Injuries	Approach to patient with traumatic injuries	3.0	1.2	4.2	25.4	1.4	1.5	2.9	17.9
Course total		10.3	6.1	16.4	100.0	10.3	6.1	16.4	100.0

DISCUSSION

Curriculum mapping and blueprinting were practical means of adapting the programme and improving contextual relevancy, and are likely translatable to similar programmes in other LMIC settings.

Significant changes were required for the Zambian EFAR programme to be contextually-relevant. The original and refined curriculums share only a single similarity in distribution across their six modules: medical emergencies. One module – introduction and scene management – saw a significant increase in time and three modules – obstetrics and gynaecology, unconsciousness and near unconsciousness, and injuries – were deemphasised in the final curriculum. The environmental emergencies module remained an insignificant portion of the curriculum. The medical emergencies module likely remained similar due to the burdens of infectious and non-communicable diseases being relatively similar between Zambia and South Africa.^{47 48}

Deemphasising the obstetric and injury sections was not predicted, given the well-documented burdens in Zambia.³⁵ Obstetric and gynaecologic emergencies, such as complicated delivery or post-partum haemorrhage, lead to high maternal mortality rates in Zambia,^{35 49} but they were not seen by EFARs in our study. The reasons behind this are unknown: it may suggest that existing systems to handle obstetric and gynaecologic emergencies in the Kasama region are adequate, but could equally be due to EFARs feeling disempowered in such cases and therefore not responding. Similarly, injuries accounted for nearly 40% of EFAR chief complaints and reviewers are likely intimately aware of the local burden of injury.^{50 51} Trauma care reflected this, ranking consistently high in mapping and blueprinting. Yet, injury was deemphasised in the final curriculum. A likely explanation for this is that trauma care was actually overrepresented in the original EFAR curriculum due to the extremely large burden of trauma in South Africa in comparison to Zambia.^{4 50 52 53} Further work is required to explore the mismatch in both fields.

Introduction and scene management saw a 242% increase in learning time. In the context of the EFAR programme's main goal – training laypeople to handle the emergencies at a basic level – this result can be seen as successful. EFARs should be spending more time focusing on introductory material that will help them to handle a variety of emergencies. These results parallel other layperson responder programmes, which also place emphasis on broad skills that can aid patients presenting with a range of conditions.^{30 34} While environmental emergencies were included in the original curriculum, they were not included in the course programme that was implemented. Therefore, a before-and-after comparison could not be made, and the total time devoted in the original curriculum was denoted as zero. The percentage of total time in the refined curriculum is only around 3%, speaking to why it may not have been included in the first place: local and programmatic experts do not perceive it to be important.

We believe the refined curriculum will be effective in instructing Zambian EFARs, and in preparing them to manage the emergencies they are most likely to face. This study highlights that no two settings are the same: even between South Africa and Zambia, the course breakdown differs significantly. It is important to consider the context at the start, and to reconsider it at scheduled time intervals, as these LMIC regions are rapidly changing. A refinement process such as this should be used to ensure an appropriate and evolved curriculum is in place as any medical education programme expands.

The EFAR programme, and layperson first response systems in general, are cost effective means of reducing morbidity and mortality in LMICs.^{27 54} These short courses must train up people with minimal prior knowledge in a short span - typically one to five days.^{4 34} As such, course time must be maximised. Mapping and blueprinting can be leveraged to ensure that this occurs. Where curriculums exist, it allows updating of the curriculum to ensure it is context-appropriate. Where no curriculum currently exists, programme developers might use these methods instead to generate an initial curriculum.

It has also proven challenging to identify methods that allow for adaption of programmes to other regions, while maintaining low cost. There are few appropriate strategies for designing educational programmes in LMICs and training community members.⁵⁵ Current literature focuses on resource-heavy methods used in high-income countries, but these are unrealistic in LMICs. The curriculum refinement methods we describe are an efficient way of tailoring programmes to local needs, without heavy reliance on data collection and research personnel. Although the method has two stages, it is cost- and time-effective. Adaptations were easily made throughout the process as needed, from the size of the expert group to the definitions of impact and frequency for blueprinting.

Together, the EFAR model and curriculum refinement methods provide a flexible framework for development and expansion of layperson medical education programmes. These community-based programmes are vitally important to LMIC health systems development, and should be prioritised.

There are several limitations in this study. Based on original communications, we anticipated that data would be collected from two sites. One site did not have any data, and the second had significantly fewer PRFs available than predicted. The sample size was sufficient, but additional data would give a clearer picture of the types of chief complaints EFARs are presented with. It is not uncommon to be without sufficient data sets in LMICs,⁶⁻⁸ which supports the importance of utilising methods such as mapping and blueprinting that rely on minimal data in addition to other factors, such as expert knowledge. While this limits transcautivity of curriculum itself across other LMIC regions, it does not decrease limit translatability of our conclusion: curriculum mapping and blueprinting are practical methods of refining educational programmes to increase contextual relevancy.

The expert group that conducted curricular reviews was limited in size and nature. While the group included only physicians with significant knowledge about the Zambian context, community members and past EFAR trainees, who may have a different expectation of the scope of the EFAR course, were not engaged. Laypersons would likely need to be included in future studies through a simpler process, such as focus groups; however, current literature provides minimal guidance on how to incorporate this qualitative data into a weighted curriculum.

Additionally, the study only included quantitative data. Written commentary collected from reviewers was not incorporated. As such, potentially useful and nuanced comments were not factored into the final weightings of the curriculum. In future iterations, developers should consider methodology that allows for the consideration of various sources of qualitative data in generating the final curriculum.

Results of the study are informing an improved curriculum, to be introduced in-country alongside improved monitoring and evaluation methods later in 2017. Pedagogy for EFAR learners will be

1
2
3 explored during implementation, to ensure that the course content outline in the curriculum is
4 effectively reaching EFAR learners. Ongoing data collection will monitor learning retention, facilitate
5 assessment of EFAR sites, and allow efficient curriculum refinement at scheduled time points in the
6 future.
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ETHICAL CONSIDERATIONS

Ethical approval was obtained by the Human Research Ethics Committees at both the University of Cape Town and the University of Zambia.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

No additional data are available.

CONTRIBUTORSHIP

JLP, MK, CC, and LAW conceived the study and contributed to its design. JLP carried out data collection and analysis, and drafted the manuscript. All authors contributed to the manuscript's revision and approved the final version for submission.

ACKNOWLEDGEMENTS

The research team would like to thank the expert review group for their efforts. We would also like to extend our gratitude to Dr Heike Geduld, without whose insight into curriculum development, this project would not have been possible.

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Online Supplement 1: Results of curriculum mapping for topics.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for the Introduction & Scene Management module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management			
	The need for first aid training	History of emergency care & Zambian first aid	Zambian healthcare levels & referral system	Definition of an emergency
Chest pain (2)	5	5	1	5
Hypo/hyperglycaemia (5)	5	5	1	5
Diarrhoea/constipation (2)	5	5	1	5
Nausea/vomiting (1)	5	5	1	5
Abdominal pain/distention (1)	5	5	1	5
Suspected malaria (2)	5	5	1	5
Intoxication (2)	5	5	1	5
Loss of consciousness/fainting (3)	5	5	1	5
Seizure/convulsion (11)	5	5	1	5
Extremity pain (1)	5	5	1	5
Asthma/wheezing (9)	5	5	1	5
Cough (2)	5	5	1	5
Difficulty in breathing (2)	5	5	1	4
Foreign body airway obstruction (8)	0	0	1	0
Dehydration (5)	5	5	1	5
HIV complication (1)	5	5	1	5
Suspected anaemia (2)	5	5	1	5
Swelling (1)	5	5	1	5
Bee sting	5	5	1	5
Back injury	5	5	1	5
Bleeding (27)	5	5	1	5
Burn (1)	5	5	1	5
Chest injury	5	5	1	5
Extremity injury (2)	5	5	1	5
Head or neck injury (3)	5	5	1	5
Injury (unspecified) (3)	0	0	1	0
Open wound (2)	0	0	1	0
Road traffic accident (2)	0	0	1	0
Dislocation injury (1)	0	0	1	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Principles of first aid	Limitations of first aid	Responsibilities & aims	Qualities of first aid
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	0	0	0	5
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)				
	Socrates & doing harm	Good Samaritan law/Legal protection of EFARs	Definition of negligence	Patient abandonment	Patient consent
Chest pain (2)	5	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5	5
Nausea/vomiting (1)	5	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5	5
Suspected malaria (2)	5	5	5	5	5
Intoxication (2)	5	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5	5
Seizure/convulsion (11)	5	5	5	5	5
Extremity pain (1)	5	5	5	5	5
Asthma/wheezing (9)	5	5	5	5	5
Cough (2)	5	5	5	5	5
Difficulty in breathing (2)	5	5	5	5	5
Foreign body airway obstruction (8)	0	1	0	0	0
Dehydration (5)	5	5	5	5	5
HIV complication (1)	5	5	5	5	5
Suspected anaemia (2)	5	5	5	5	5
Swelling (1)	5	5	5	5	5
Bee sting	5	5	5	5	5
Back injury	5	5	5	5	5
Bleeding (27)	5	5	5	5	5
Burn (1)	5	5	5	5	5
Chest injury	5	5	5	5	5
Extremity injury (2)	5	5	5	5	5
Head or neck injury (3)	5	5	5	5	5
Injury (unspecified) (3)	0	0	0	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	0	0	0	0	0
Dislocation injury (1)	0	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Hospital hand-over	Police reporting	Documentation & reporting	Religion, culture & tradition
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	0	0	0	0
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)		
	Calling for help	Scene size-up	Scene safety & PPE
Chest pain (2)	5	5	5
Hypo/hyperglycaemia (5)	5	5	5
Diarrhoea/constipation (2)	5	5	5
Nausea/vomiting (1)	5	5	5
Abdominal pain/distention (1)	5	5	5
Suspected malaria (2)	5	5	5
Intoxication (2)	5	5	5
Loss of consciousness/fainting (3)	5	5	5
Seizure/convulsion (11)	5	5	5
Extremity pain (1)	5	5	5
Asthma/wheezing (9)	5	5	5
Cough (2)	5	5	5
Difficulty in breathing (2)	5	5	5
Foreign body airway obstruction (8)	0	0	0
Dehydration (5)	5	5	5
HIV complication (1)	5	5	5
Suspected anaemia (2)	5	5	5
Swelling (1)	5	5	5
Bee sting	5	5	5
Back injury	5	5	5
Bleeding (27)	5	5	5
Burn (1)	5	5	5
Chest injury	5	5	5
Extremity injury (2)	5	5	5
Head or neck injury (3)	5	5	5
Injury (unspecified) (3)	0	0	0
Open wound (2)	0	0	0
Road traffic accident (2)	0	0	0
Dislocation injury (1)	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Communication	Airway	Breathing	Circulation
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	4	4	4	4
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	4	5	5	5
Open wound (2)	5	5	0	0
Road traffic accident (2)	5	5	0	5
Dislocation injury (1)	5	5	5	5

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Disability & exposure	Reassessment	Infection prevention	MCIs ¹
Chest pain (2)	5	5	0	1
Hypo/hyperglycaemia (5)	4	5	0	1
Diarrhoea/constipation (2)	5	5	1	1
Nausea/vomiting (1)	4	5	1	1
Abdominal pain/distention (1)	5	5	0	1
Suspected malaria (2)	4	5	1	1
Intoxication (2)	5	5	0	1
Loss of consciousness/fainting (3)	4	5	0	1
Seizure/convulsion (11)	5	5	0	1
Extremity pain (1)	4	5	0	1
Asthma/wheezing (9)	5	5	1	1
Cough (2)	4	5	1	1
Difficulty in breathing (2)	5	5	1	1
Foreign body airway obstruction (8)	4	4	0	1
Dehydration (5)	5	5	0	1
HIV complication (1)	4	5	1	1
Suspected anaemia (2)	5	5	1	1
Swelling (1)	4	5	0	1
Bee sting	5	5	0	1
Back injury	4	5	0	1
Bleeding (27)	5	5	1	1
Burn (1)	4	5	0	1
Chest injury	5	5	0	1
Extremity injury (2)	4	5	0	1
Head or neck injury (3)	5	5	0	1
Injury (unspecified) (3)	4	5	0	1
Open wound (2)	0	5	1	1
Road traffic accident (2)	4	5	0	1
Dislocation injury (1)	4	5	1	1

¹ MCI: Mass casualty incident

Table 2: Results of curriculum mapping for the Injuries module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Injuries					
	Approach to patient	First aid for common sports injuries	Head & spinal injuries	Bleeding	Fractures & soft tissue injuries	Burns
Chest pain (2)	5	0	5	5	5	0
Hypo/hyperglycaemia (5)	5	0	5	5	5	0
Diarrhoea/constipation (2)	5	0	5	5	5	0
Nausea/vomiting (1)	5	0	5	5	5	0
Abdominal pain/distention (1)	5	0	5	5	5	0
Suspected malaria (2)	5	0	5	5	5	0
Intoxication (2)	5	0	5	5	5	0
Loss of consciousness/fainting (3)	5	0	5	5	5	0
Seizure/convulsion (11)	5	0	5	5	5	0
Extremity pain (1)	5	0	5	5	5	0
Asthma/wheezing (9)	5	0	5	5	5	0
Cough (2)	5	0	5	5	5	0
Difficulty in breathing (2)	5	0	5	5	5	0
Foreign body airway obstruction (8)	4	0	4	4	4	0
Dehydration (5)	5	0	5	5	5	0
HIV complication (1)	5	0	5	5	5	0
Suspected anaemia (2)	5	0	5	5	5	0
Swelling (1)	5	0	5	5	5	0
Bee sting	5	0	5	5	5	0
Back injury	5	1	5	5	5	0
Bleeding (27)	5	1	5	5	5	0
Burn (1)	5	1	5	5	5	0
Chest injury	5	1	5	5	5	0
Extremity injury (2)	5	1	5	5	5	0
Head or neck injury (3)	5	1	5	5	5	0
Injury (unspecified) (3)	5	1	5	5	5	0
Open wound (2)	5	1	0	5	0	0
Road traffic accident (2)	5	0	5	5	0	0
Dislocation injury (1)	5	1	5	5	5	0

Table 3: Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies				
	Unconscious- ness	Stroke	Seizures	Fever	Hypo- glycaemia
Chest pain (2)	0	0	0	0	0
Hypo/hyperglycaemia (5)	5	2	5	0	5
Diarrhoea/constipation (2)	0	0	0	5	0
Nausea/vomiting (1)	0	1	0	5	0
Abdominal pain/distention (1)	0	0	0	5	0
Suspected malaria (2)	0	0	1	5	0
Intoxication (2)	5	1	5	0	5
Loss of consciousness/fainting (3)	5	5	5	1	5
Seizure/convulsion (11)	5	2	5	5	5
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	0
Cough (2)	0	0	0	5	0
Difficulty in breathing (2)	0	0	0	5	0
Foreign body airway obstruction (8)	4	0	0	0	0
Dehydration (5)	0	0	0	0	0
HIV complication (1)	0	0	0	1	0
Suspected anaemia (2)	0	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding (27)	5	0	0	0	0
Burn (1)	0	0	0	0	0
Chest injury	0	0	0	0	0
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	0	0	0	0	0
Injury (unspecified) (3)	0	0	0	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	1	0	0	1	1
Dislocation injury (1)	0	0	0	0	0

Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies (cont.)				
	Dehydration	Drug & substance abuse & psychosis	Poisoning	Anaphylaxis	Difficulty breathing
Chest pain (2)	0	0	0	0	1
Hypo/hyperglycaemia (5)	0	0	0	0	0
Diarrhoea/constipation (2)	5	1	1	0	0
Nausea/vomiting (1)	5	1	1	0	0
Abdominal pain/distention (1)	0	1	1	0	0
Suspected malaria (2)	0	0	0	0	0
Intoxication (2)	5	5	5	0	5
Loss of consciousness/fainting (3)	5	1	1	0	5
Seizure/convulsion (11)	5	0	1	0	5
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	5
Cough (2)	0	0	0	0	5
Difficulty in breathing (2)	0	0	0	0	5
Foreign body airway obstruction (8)	0	0	0	0	5
Dehydration (5)	5	0	0	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	0	0	0	0	1
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	1	0
Back injury	0	0	0	0	0
Bleeding (27)	4	0	0	0	0
Burn (1)	5	0	0	0	0
Chest injury	0	0	0	0	1
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	0	0	0	0	0
Injury (unspecified) (3)	4	0	0	0	0
Open wound (2)	4	0	0	0	0
Road traffic accident (2)	4	0	0	0	1
Dislocation injury (1)	4	0	0	0	0

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Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies (cont.)				
	Headache	Chest pain	Abdominal pain	Extremity pain	Generalised pain
Chest pain (2)	0	5	0	0	0
Hypo/hyperglycaemia (5)	5	0	0	0	0
Diarrhoea/constipation (2)	0	0	5	0	0
Nausea/vomiting (1)	1	1	5	0	0
Abdominal pain/distention (1)	0	0	5	0	0
Suspected malaria (2)	5	0	0	0	0
Intoxication (2)	5	0	5	0	0
Loss of consciousness/fainting (3)	1	1	0	0	0
Seizure/convulsion (11)	1	0	0	0	0
Extremity pain (1)	0	0	0	5	5
Asthma/wheezing (9)	0	5	0	0	0
Cough (2)	0	5	0	0	0
Difficulty in breathing (2)	0	5	0	0	0
Foreign body airway obstruction (8)	0	0	0	0	0
Dehydration (5)	1	0	5	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	5	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding (27)	0	0	0	0	0
Burn (1)	0	0	0	0	0
Chest injury	0	5	0	0	0
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	5	0	0	0	0
Injury (unspecified) (3)	1	1	1	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	2	1	1	0	0
Dislocation injury (1)	0	0	0	0	0

Table 4: Results of curriculum mapping for the Obstetrics & Gynaecology module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Obstetric & Gynaecology
Chest pain (2)	0
Hypo/hyperglycaemia (5)	0
Diarrhoea/constipation (2)	0
Nausea/vomiting (1)	0
Abdominal pain/distention (1)	3
Suspected malaria (2)	0
Intoxication (2)	0
Loss of consciousness/fainting (3)	1
Seizure/convulsion (11)	0
Extremity pain (1)	0
Asthma/wheezing (9)	0
Cough (2)	0
Difficulty in breathing (2)	0
Foreign body airway obstruction (8)	0
Dehydration (5)	0
HIV complication (1)	0
Suspected anaemia (2)	0
Swelling (1)	0
Bee sting	0
Back injury	0
Bleeding (27)	5
Burn (1)	0
Chest injury	0
Extremity injury (2)	0
Head or neck injury (3)	0
Injury (unspecified) (3)	0
Open wound (2)	0
Road traffic accident (2)	0
Dislocation injury (1)	0

Table 5: Results of curriculum mapping for the Environmental Emergencies section. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Environmental Emergencies			
	Bites & stings	Electrocution	Lightning	Drowning
Chest pain (2)	0	1	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	0	0	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	0	0	0	0
Suspected malaria (2)	0	0	0	0
Intoxication (2)	0	0	0	0
Loss of consciousness/fainting (3)	0	2	2	1
Seizure/convulsion (11)	0	1	2	0
Extremity pain (1)	1	0	1	0
Asthma/wheezing (9)	1	0	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	2	0	0	3
Foreign body airway obstruction (8)	0	0	0	0
Dehydration (5)	0	0	0	0
HIV complication (1)	0	0	0	0
Suspected anaemia (2)	0	0	0	0
Swelling (1)	2	0	0	0
Bee sting	5	0	0	0
Back injury	0	1	1	0
Bleeding (27)	0	0	0	0
Burn (1)	0	2	3	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	1	1	0
Injury (unspecified) (3)	0	1	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	1	0	0

Online Supplement 2: Results of curriculum mapping for skills.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for bandaging, fracture stabilisation, BVM¹ use & C-spine stabilisation.

Skill Chief complaint (n)	Bandaging open wounds	Basic fracture stabilisation	BVM use	C-spine stabilisation
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

¹ BVM: Bag-valve mask

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Table 2: Results of curriculum mapping for calling for help, CPR², defibrillation & documentation.

Skill Chief complaint (n)	Calling for help via mobile phone	CPR	Defibrillation	Documentation
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

² CPR: Cardiopulmonary resuscitation

Table 3: Results of curriculum mapping for first aid fundamentals, obtaining consent, airway maintenance & patient extrication.

Skill Chief complaint (n)	Fundamentals of first aid	Obtaining consent	Opening/maint aining airway	Patient extrication
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 4: Results of curriculum mapping for patient transport, primary patient assessment, recovery position & scene size-up.

Skill Chief complaint (n)	Patient transport	Primary patient assessment	Recovery position	Scene size-up
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 5: Results of curriculum mapping for secondary patient assessment, trauma assessment, triage & PPE³ usage.

Skill Chief complaint (n)	Secondary patient assessment	Trauma assessment	Triage	Using PPE
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

³ PPE: Personal protective equipment

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Table 6: Results of curriculum mapping for glucometer use, delivery, malaria rapid testing, log rolling & pre-hospital ECG⁴ use.

Skill Chief complaint (n)	Using a glucometer	Delivery	Malaria rapid test	Log rolling	Pre-hospital ECG
Chest pain (2)	0	0	0	0	0
Hypo/hyperglycaemia (5)	5	0	0	0	0
Diarrhoea/constipation (2)	0	0	0	0	0
Nausea/vomiting (1)	0	0	0	0	0
Abdominal pain/distention (1)	0	0	0	0	0
Suspected malaria (2)	0	0	1	0	0
Intoxication (2)	0	0	0	0	0
Loss of consciousness/fainting (3)	0	0	0	0	0
Seizure/convulsion (11)	0	0	0	0	0
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	0
Cough (2)	0	0	0	0	0
Difficulty in breathing (2)	0	0	0	0	0
Foreign body airway obstruction (8)	0	0	0	0	0
Dehydration (5)	0	0	0	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	0	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	1	0
Bleeding (27)	0	0	0	1	0
Burn (1)	0	0	0	1	0
Chest injury	0	0	0	1	0
Extremity injury (2)	0	0	0	1	0
Head or neck injury (3)	0	0	0	1	0
Injury (unspecified) (3)	0	0	0	1	0
Open wound (2)	0	0	0	1	0
Road traffic accident (2)	0	0	0	1	0
Dislocation injury (1)	0	0	0	1	0

⁴ ECG: Electrocardiogram

Online Supplement 3: Results of curriculum blueprinting for topics and subtopics.

Curriculum topic(s)	Curriculum sub-topics	Impact	Frequency	I x F	Relative %	Weight	Section weight total
Introduction to emergency care	The need for first aid training	3.00	2.00	6.00	2.25	0.02	0.07
	History of emergency care & Zambian first aid	1.60	1.60	2.56	0.96	0.01	
	Zambian healthcare levels & referral system	2.40	1.80	4.32	1.62	0.02	
	Definition of an emergency	2.40	2.20	5.28	1.98	0.02	
Basic fundamentals of first aid	Principles of first aid	3.00	2.20	6.60	2.47	0.02	0.09
	Limitations of first aid	2.80	2.20	6.16	2.31	0.02	
	Responsibilities & aims	2.60	1.80	4.68	1.75	0.02	
	Qualities of first aid	2.60	2.20	5.72	2.14	0.02	
Medical-legal aspects of care	Socrates & doing harm	2.40	2.00	4.80	1.80	0.02	0.08
	Good Samaritan law/legal protection of EFARs ¹	2.40	2.00	4.80	1.80	0.02	
	Definition of negligence	2.00	1.40	2.80	1.05	0.01	
	Patient abandonment	2.00	1.80	3.60	1.35	0.01	
	Patient consent	2.20	2.00	4.40	1.65	0.02	
Procedures & implications of providing care	Hospital hand-over	2.00	1.40	2.80	1.05	0.01	0.02
	Police reporting	1.20	1.40	1.68	0.63	0.01	
	Documentation & reporting	1.40	1.40	1.96	0.73	0.01	
Religion, culture & tradition		0.50	0.33	0.17	0.06	0.00	0.00
Assessing the scene	Calling for help	2.60	2.40	6.24	2.34	0.02	0.06
	Scene size-up	2.60	2.00	5.20	1.95	0.02	
	Scene safety & PPE ²	2.60	2.00	5.20	1.95	0.02	
Patient primary assessment	Communication	2.40	2.00	4.80	1.80	0.02	0.09
	Airway	3.00	2.20	6.60	2.47	0.02	
	Breathing	3.00	2.20	6.60	2.47	0.02	

¹ EFAR: Emergency first aid responder² PPE: Personal protective equipment

	Circulation	2.80	2.20	6.16	2.31	0.02	
Patient secondary assessment	Disability & exposure	2.80	1.80	5.04	1.89	0.02	0.04
	Reassessment	2.40	2.60	6.24	2.34	0.02	
Trauma	Approach to patient	2.80	2.40	6.72	2.52	0.03	0.14
	First aid for common sports injuries	2.60	2.20	5.72	2.14	0.02	
	Head & spinal injuries	2.60	1.80	4.68	1.75	0.02	
	Bleeding	2.80	3.00	8.40	3.15	0.03	
	Fractures & soft tissue injuries	2.40	2.60	6.24	2.34	0.02	
	Burns	2.60	2.20	5.72	2.14	0.02	
Unconsciousness		3.00	2.60	7.80	2.92	0.03	0.03
Stroke		2.40	1.80	4.32	1.62	0.02	0.02
Seizures		2.80	2.40	6.72	2.52	0.03	0.03
Fever		2.80	3.00	8.40	3.15	0.03	0.03
Hypoglycaemia		2.80	2.60	7.28	2.73	0.03	0.03
Dehydration		2.80	3.00	8.40	3.15	0.03	0.03
Drug & substance abuse & psychosis		2.00	1.40	2.80	1.05	0.01	0.01
Poisoning		2.20	1.40	3.08	1.15	0.01	0.01
Anaphylaxis		2.60	1.40	3.64	1.36	0.01	0.01
Breathing difficulties		2.60	2.60	6.76	2.53	0.03	0.03
Severe pain	Headache	2.20	2.40	5.28	1.98	0.02	0.09
	Chest pain	2.60	2.20	5.72	2.14	0.02	
	Abdominal pain	2.60	2.40	6.24	2.34	0.02	
	Extremity pain	1.75	1.75	3.06	1.15	0.01	
	Generalised pain	1.80	1.60	2.88	1.08	0.01	
Obstetric & gynaecological emergencies		2.25	1.25	2.81	1.05	0.01	0.01
Environmental emergencies	Bites & stings	2.00	1.80	3.60	1.35	0.01	0.05
	Electrocution	2.60	1.20	3.12	1.17	0.01	
	Lightning	1.80	1.20	2.16	0.81	0.01	
	Drowning	2.40	1.40	3.36	1.26	0.01	
Mass casualty incidents		2.80	1.60	4.48	1.68	0.02	0.02
Infection prevention		2.80	2.60	7.28	2.73	0.03	0.03

Online Supplement 4: Results of curriculum blueprinting for skills.

Skills	Impact	Frequency	I x F	Relative %	Weight
Defibrillation	1.60	0.75	1.20	1.09	0.01
Documentation	1.60	1.25	2.00	1.81	0.02
CPR ¹	2.20	1.00	2.20	2.00	0.02
Pre-hospital ECG ²	2.40	1.00	2.40	2.18	0.02
Malaria rapid test	1.80	1.50	2.70	2.45	0.02
BVM ³ use	2.40	1.25	3.00	2.72	0.03
Delivery	2.40	1.50	3.60	3.27	0.03
Using a glucometer	2.40	1.50	3.60	3.27	0.03
Obtaining consent	2.20	1.75	3.85	3.49	0.03
Secondary patient assessment	2.20	1.75	3.85	3.49	0.03
Log rolling	2.40	1.75	4.20	3.81	0.04
Using PPE ⁴	2.20	2.00	4.40	3.99	0.04
Patient extrication	2.60	1.75	4.55	4.13	0.04
Triage	2.60	1.75	4.55	4.13	0.04
Basic fracture stabilisation	2.40	2.00	4.80	4.35	0.04
C-spine stabilisation	2.80	1.75	4.90	4.44	0.04
Scene size-up	2.40	2.25	5.40	4.90	0.05
Fundamentals of first aid	2.80	2.00	5.60	5.08	0.05
Patient transport	2.80	2.00	5.60	5.08	0.05
Recovery position	2.60	2.25	5.85	5.31	0.05
Opening/maintaining airway	3.00	2.00	6.00	5.44	0.05
Bandaging open wounds	2.60	2.50	6.50	5.90	0.06
Calling for help via mobile phone	2.60	2.50	6.50	5.90	0.06
Primary patient assessment	2.60	2.50	6.50	5.90	0.06
Trauma assessment	2.60	2.50	6.50	5.90	0.06

¹ CPR: Cardiopulmonary resuscitation² ECG: Electrocardiogram³ BVM: Bag-valve mask⁴ PPE: Personal protective equipment

BMJ Open

Adapting the Emergency First Aid Responder course for Zambia through curriculum mapping and blueprinting

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2017-018389.R3
Article Type:	Research
Date Submitted by the Author:	27-Oct-2017
Complete List of Authors:	Pigoga, Jennifer; University of Cape Town Department of Emergency Medicine Cunningham, Charmaine; University of Cape Town, Division of Emergency Medicine Kafwamfwa, Muhumpu; Zambian Ministry of Health, Mobile & Emergency Health Services Wallis, Lee; University of Cape Town, Surgery
Primary Subject Heading:	Medical education and training
Secondary Subject Heading:	Medical education and training, Global health, Emergency medicine
Keywords:	MEDICAL EDUCATION & TRAINING, ACCIDENT & EMERGENCY MEDICINE, Layperson first response, Emergency Medical Services, Emergency Care

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**Adapting the Emergency First Aid Responder course
for Zambia through curriculum mapping and blueprinting**

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WORD COUNT: 3668
TABLE COUNT: 3
FIGURE COUNT: 0
NUMBER OF SUPPLEMENTARY FILES: 4
NUMBER OF REFERENCES: 53

ABSTRACT

Objectives: Community members are often the first to witness and respond to medical and traumatic emergencies, making them an essential first link to emergency care systems. The Emergency First Aid Responder (EFAR) programme is short course originally developed to help South Africans manage emergencies at the community-level, pending arrival of formal care providers. EFAR was implemented in two rural regions of Zambia in 2015, but no changes were originally made to tailor the course to the new setting. We undertook this study to identify potential refinements in the original EFAR curriculum, and to adapt it to the local context in Zambia.

Design: The EFAR curriculum was mapped against available chief complaint data. An expert group used information from the map, in tandem with personal knowledge, to rank each course topic for potential impact on patient outcomes and frequency of use in practice. Individual blueprints were compiled to generate a refined EFAR curriculum, the time breakdown of which reflects the relative weight of each topic.

Setting: This study was conducted based on data collected in Kasama, a rural region of Zambia's Northern Province.

Participants: An expert group of five physicians practicing emergency medicine was selected; all reviewers have expertise in the Zambian context, EFAR programme, and/or curriculum development.

Results: The range of emergencies that Zambian EFARs encounter indicates that the course must be broad in scope. The refined curriculum covers 54 topics (seven new) and 25 practical skills (five new). Practical and didactic time devoted to general patient care and scene management increased significantly, while time devoted to most other clinical, presentation-based categories (e.g. trauma care) decreased.

Conclusions: Discrepancies between original and refined curricula highlight a mismatch between the external curriculum and local context. Even with limited data and resources, curriculum mapping and blueprinting are possible means of resolving these contextual issues.

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ARTICLE SUMMARY

- The study highlights the importance of tailoring medical education curriculums to local context.
- It adds to a limited evidence base surrounding the refinement of medical education curriculums in LMICs.
- The curriculum mapping and blueprinting methodology presented in this study is likely useful in most low-resource settings.
- The translatability of the curriculum generated through this study is limited, as data were only collected from a single site in rural Zambia.
- These methods did not account for qualitative commentary data and community member input, which might have been useful in informing the final curriculum.

INTRODUCTION

Emergency care encompasses a range of time-sensitive health services provided for acute medical, surgical, and obstetric conditions to avoid death or disability. Although well-embedded into the healthcare systems of many high-income countries, the establishment of emergency care in low- and middle- income countries (LMICs) remains an ongoing challenge, despite the central role it can play in the health system.¹⁻⁵ Even allowing for poor reporting mechanisms,⁶⁻⁸ it is clear that LMICs are burdened by the highest rates of injury and illness in nearly every category,⁹⁻¹³ and vulnerable populations within these nations are at particular risk.¹⁴⁻¹⁷ These emergencies come at high cost, directly affecting the psychosocial, health, productivity, and economic status of LMICs.^{4 18-24}

While regular and timely access to medical care should be of utmost importance in LMICs, numerous barriers, including rural living and negative financial implications, prevent this from occurring in a manner envisaged by the longitudinal primary care model.^{1 2 4} As a result, emergency care is the first point of contact with the health system for a great many people worldwide (including the poor and uninsured in high-income countries). Emergency care systems have the potential to reduce deaths in LMICs by 54%;^{25 26} the prehospital component alone is also highly effective, reducing trauma-related mortality by up to 25%.²⁷

Prehospital emergency care systems modelled on those in high-income countries are unaffordable for most LMICs, which are in need of a less-expensive model.^{1 28} This model should be able to serve either as a foundation for prehospital care in areas where it does not exist, or as a support system to help newer prehospital care systems grow into maturity.²⁹ The Emergency First Aid Responder (EFAR) programme, which was developed in 2010 to meet the emergency care needs of low-resource areas in South Africa, satisfies these criteria.⁴ EFAR relies upon community involvement, on the basis that training a large number of community members will increase the likelihood that an EFAR is present or near to any emergency that may occur. Through community-specific trainings, EFARs are taught to provide life-saving care in the interim before ambulance arrival. Similar short courses geared towards layperson responders have proven effective in other LMICs.³⁰⁻³⁴

Zambia is a lower-middle-income Southern African nation of 16.2 million.³⁵ It may be considered a fairly typical African LMIC: although the country is urbanising, the majority of Zambians continue to live in rural areas and below the poverty line.³⁵ Maternal and infant mortality rates are high,³⁶ and the majority of premature deaths are preventable, stemming from injuries and infectious disease.³⁵ Emergency care systems in Zambia are insufficient, and there is no national ambulance service.³⁷ Most healthcare is public, provided collaboratively by the Zambian Ministry of Health and Zambian Defence Force, but the healthcare workforce remains inadequate.^{35 37} In order to improve emergency care, as the Zambian Ministry of Health and Zambian Defence Force have stated they wish to do, a multi-faceted approach needs to be taken. Providers must be trained and hospital care must be improved, but, in the meantime, Zambians must be empowered to handle emergencies on the community-level.³⁸

In a 2014 needs assessment, Zambians identified that a grassroots community response programme could facilitate the eventual formation of a strong and formal prehospital care system in their country.³⁹ Motivated by this, the Zambian Ministry of Health and Zambian Defence Force implemented the EFAR programme in 2015 in two rural villages: Kasama and Nyimba. The programme utilises community health centres to recruit participants and hold trainings.⁴⁰ These centres are staffed by the Zambian Defence Force, but serve both military personnel and the civilians in the region. There has since been concern that the Zambian EFAR curriculum – which was not modified from the original South African programme – was not a good fit for the emergency care needs of rural Zambian communities. The Zambian setting differs from the South African one in many ways: it is rural, less violent, has less existing infrastructure, and overall different culture and lifestyles. All of these factors are likely to influence the types of emergencies seen, and yet, existing local resources and needs have not been reflected in the EFAR curriculum.

Most educators focus primarily on adapting medical education curriculums as science surrounding course content evolves. But, secondarily, it is also necessary to tailor curriculums to local needs and resources. This is especially important in LMICs, where resource levels and health systems infrastructure can vary drastically

even within a region. Curriculum mapping is a method of spatially representing the components of a curriculum that allows for identification of gaps and overlaps in course content.^{41 42} Curriculum mapping has become well-accepted in the medical community in high-income countries as a means of keeping up with an ever-increasing knowledge base. It not only facilitates ongoing curricular evaluation, but also, rapid improvement and evolution,⁴³ and has been shown to improve educational outcomes.⁴²

In the case of the EFAR curriculum, the purpose of curriculum mapping was to align curricular elements (the topics and skills covered in the course) with the emergency care needs of the regional population. The map alone does not yield a weighted curriculum breakdown. Instead, it serves as a source of information for a second refinement process. Curriculum blueprinting, as defined by Coderre *et al.*, builds off the map, yielding a quantified distribution of curricular topics.⁴⁴ With expert input, curricular elements are weighted for both impact of learning the element as well as frequency with which the element is seen in the field. From the quantitative data that results, learning objectives and experiences can be revised.⁴⁴ These two methods – curriculum mapping and course blueprinting – have revolutionised the way in which modern medical education is planned, taught, and assessed. While commonplace in high-income countries, there is a little evidence surrounding the use of mapping and blueprinting in LMICs. An understanding of the importance of curriculum development has translated to some regions of sub-Saharan Africa, but implementing development methods has been noted as challenging in environments that already lack manpower and other resources.⁴⁵ We believe that curriculum mapping and blueprinting could be an effective means of refining course context and scope, thus positively impacting the development of medical education in LMICs.

This study sought to utilise existing EFAR data and expert input to identify potential refinements and adapt the EFAR curriculum to Zambia.

METHODS

EFAR site data collection & analysis

Previous communications indicated that the EFAR patient run forms (PRFs) were being stored at the two Zambian Defence Force health centres where trainings had been held. All EFAR-patient interactions logged between July 2015 and June 2016 were collected, retrospectively up until March 2016 and then prospectively. Data included patient demographics, chief complaints, presentations, and dispositions. No identifying information was collected. Data were entered into encrypted Microsoft Excel (© Microsoft, Richmond, WA) spreadsheets on-site. Basic statistics were generated using SAS 9.4 Software (© SAS, Cary, NC).

Curriculum refinement

Selecting an expert group

Conducting a successful curriculum refinement requires a group of experienced educators, topic opinion leaders, and medical professionals. The group may be as small as three members for a short learning experience, but should grow in size as the complexity of the learning experience increases.⁴⁶

A group of five was deemed appropriate for this study. Reviewers were identified via email. All were physicians practicing emergency medicine. Reviewers were also required to have expertise in the Zambian context, the EFAR programme, and/or curriculum development.

Curriculum mapping

The lead researcher generated two initial curriculum maps – one for course topics and another for skills - by mapping all curricular elements against all chief complaints (extracted from PRFs) in Microsoft Excel. Chief complaints were then matched to the existing EFAR curriculum by the lead researcher using a binary system. The relationship between each curricular element and chief complaint was directly explored. For example,

the topic “headache” was matched to the chief complaint “hypo/hyperglycaemia”, but it was not matched to another chief complaint, “difficulty in breathing”. 1’s related curricular elements that are relevant to the chief complaint, such as “headache” to “hypo/hyperglycaemia”. 0’s were not believed to be pertinent to a chief complaint, such as “headache” to difficulty in breathing”.

The expert group reviewed the initial curriculum maps, validating or changing the curricular elements that corresponded to a particular complaint. Continuing with our example, if a reviewer did not agree that the topic “headache” corresponded to the chief complaint of “hypo/hyperglycaemia” (as headache was mapped by the lead researcher), then the reviewer indicated this by changing the cell score from 1 to 0. Free text space was provided to add additional curricular elements (e.g., a topic not included in the curriculum but that the reviewer felt was important for handling the given chief complaint) and other relevant commentary.

The individual reviewer sheets for topics and skills were compiled and summed (refer to online supplements S1 and S2). Scores ranged from 0 (none of the reviewers found the curricular element important in relation to the chief complaint) to 5 (all found it important). Where reviewers suggested additional curricular elements that related to a chief complaint, these were added to the compiled map and received a score of 1. The recorded number of times EFARs were presented with each chief complaint was also added to the compiled map, for ease of reference in the blueprinting stage.

Curriculum blueprinting

The two compiled maps were given to the expert review panel, to allow them to gain a sense of: 1. How relevant the group overall felt each topic or skill was in relation to the chief complaints and 2. How frequently chief complaints are seen in Kasama.

Informed reviewers were then asked to rank curricular elements. Reviewers called upon their personal knowledge and data from the maps to score each topic twice – once for impact, and a second time for frequency (Table 1). Impact referred to usability in providing appropriate care for a patient presenting with a specific condition, while frequency related to how often the element might be used in practice. Both impact and frequency were given a rank between 1 and 3, with 1 being the least important/frequent and 3 being the most important/frequent.

It should be noted that the definitions of impact and frequency vary slightly in relation to a curricular element that is a medical or traumatic condition (e.g. a traumatic injury) versus something that can be classified as general knowledge (e.g. the Good Samaritan law) or a skill (e.g. the method of scene size-up). For the former scenario, impact is ranked based on how frequently the skill might be used in treating a condition. A reviewer will likely consider a traumatic injury to be serious and perhaps life threatening, and thus, would rank it as a 2 or 3 for impact. Based on the frequency of chief complaints given in the curriculum map, traumatic injuries are common. A reviewer would then assign the frequency to a value of 3. General knowledge refers to topics that are not actually medical conditions, but rather, concepts that supplement an EFARs ability to treat the conditions themselves. An example of this would be the topics covered under medical-legal aspects of care. Knowledge of the Good Samaritan law might be of little use in the actual provision of appropriate care, but it might be utilised relatively often. Thus, it might rank a 1 on impact and a 2 on frequency. In the context of skills, the impact and frequency definitions are similar. A reviewer may think that the primary patient assessment is a skill that’s utilised in nearly every patient encounter, and thus assign it a 3 for frequency. The reviewer may also believe it to be extremely useful in providing care, yielding a 3 for impact. The ranking system is beneficial, as it is much more efficient to analyse quantitative data versus the alternative of qualitative commentary. From these rankings, curricular elements can be weighted to give a breakdown of the curriculum in terms of time spent on each.

Table 1: Impact and frequency ranking definitions, adapted from Coderre et al.⁴⁴

Weight	Impact		Frequency	
Topic/skill is...	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)	Medical/traumatic condition (e.g. stroke)	General knowledge or skill (e.g. healthcare system or scene size-up)
1	Non-urgent	Little use in providing appropriate care	Rarely seen	Rarely utilised
2	Serious, but not immediately life threatening	Some use in providing care appropriate care	Relatively common	Occasionally utilised
3	Life threatening emergency	Extremely useful in providing care	Very common	Frequently utilised

The ranking sheets were compiled. A weighted score was calculated for each curricular element (Table 2), which represents the proportion of course time that educators should aim to spend on this curricular element. Topics correlate to didactic time, while skills correlate to practical (hands-on) time.

Table 2: An example of determining the relative weights of curricular elements. Mean impacts and frequencies are tabulated across all reviewers for all curricular elements (columns 2 and 3). The products of these impacts and frequencies are calculated for each element (column 4). Then, the IxF for each individual element is divided by the sum of all of that elements' IxF values (the total of column 4) to generate a relative weighting for each element (column 5). Column 6 represents this weight in percentage form. In this example, the skill of bandaging open wounds would take up 6% of practical course time.

Column # 1	2	3	4	5	6
Curriculum topic or skill	Mean Impact (I)	Mean Frequency (F)	IxF	$IxF/\sum(IxF)$	$[IxF/\sum(IxF)] \times 100$
Bandaging open wounds	2.6	2.5	6.5	0.06	6%

RESULTS

EFAR site data

Data availability

EFAR PRFs were available at the Kasama site. No PRFs were available at the Nyimba site.

Patient demographics

110 patients were seen by EFARs in Kasama from July 2015 to June 2016. Most (61, 56%) were male and adults (92, 84%; defined as over 11 years). The majority were brought to the Kasama Zambia Defence Force clinic (94, 86%). Nearly all patients (101, 92%) were referred to higher care.

Chief complaints

29 unique complaints were identified across medical and traumatic emergencies. When grouped based on aetiology, the most common chief complaint was known injury (39%), followed by respiratory problems (19%).

Curriculum mapping

Mapping yielded an additional seven topics and six skills, for a total of 54 topics and 26 skills.

The results of curriculum mapping are available in online supplement S1 and S2.

Curriculum blueprinting

Mean impact scores for topics ranged from 0.5 (religion, culture, and tradition) to 3.0 (principles of first aid, airway, breathing, and unconsciousness). Mean frequency scores ranged from 0.33 (religion, culture, and tradition) to 3.0 (bleeding, fever, and dehydration). Product scores ranged from 0.17 (religion, culture, and tradition) to 8.40 (bleeding, fever, and dehydration). Topics were assigned between 0.4 and 86.7 minutes of course time.

Mean impact scores for skills ranged from 1.6 (for defibrillation and documentation) to 3.0 (opening and maintaining the airway). Mean frequency scores ranged from 0.75 (defibrillation) to 2.5 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Product scores ranged from 1.20 (defibrillation) to 6.50 (bandaging, mobile phone use, patient primary assessment, and trauma assessment). Skills were assigned between 4 and 21.6 minutes of course time.

The results of curriculum mapping are available in online supplements S3 and S4.

The refined EFAR curriculum

The original curriculum had six modules, into which each of the topics and skills for the refined curriculum were categorised for ease of comparison (Table 3).

Table 3: Comparison of the modules included in the original and refined EFAR curricula.

Module	Content	Original curriculum				Refined curriculum			
		Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time	Didactic time (hr)	Practical time (hr)	Total time (hr)	% total time
Environmental Emergencies	Bites and stings, electrocution, drowning & lightening	0.0	0.0	0.0	0.0	0.5	0.0	0.5	2.9
Unconsciousness & Near Unconsciousness	General altered mental status, hypoglycaemia & substance abuse	1.3	1.2	2.5	15.2	0.7	0.2	0.9	5.4
Obstetrics & Gynaecology	Cord prolapse, antepartum and postpartum haemorrhage & emergency delivery	2.0	1.1	3.1	18.9	0.1	0.2	0.3	1.9
Introduction & Scene Management	Overview of first aid, ethical aspects, scene assessment, primary and secondary patient assessments, mass casualty incidents & infection control	2.0	1.3	3.3	20.3	5.1	2.9	8.0	48.9
Medical Emergencies	Stroke, seizure, fever, dehydration, poisoning, breathing difficulty & shock	2.0	1.3	3.3	20.3	2.5	1.3	3.8	23.0
Injuries	Approach to patient with traumatic injuries	3.0	1.2	4.2	25.4	1.4	1.5	2.9	17.9
Course total		10.3	6.1	16.4	100.0	10.3	6.1	16.4	100.0

DISCUSSION

Curriculum mapping and blueprinting were practical means of adapting the programme and improving contextual relevancy, and are likely translatable to similar programmes in other LMIC settings.

Significant changes were required for the Zambian EFAR programme to be contextually-relevant. The original and refined curriculums share only a single similarity in distribution across their six modules: medical emergencies. One module – introduction and scene management – saw a significant increase in time and three modules – obstetrics and gynaecology, unconsciousness and near unconsciousness, and injuries – were deemphasised in the final curriculum. The environmental emergencies module remained an insignificant portion of the curriculum. The medical emergencies module likely remained similar due to the burdens of infectious and non-communicable diseases being relatively similar between Zambia and South Africa.^{47 48}

Deemphasising the obstetric and injury sections was not predicted, given the well-documented burdens in Zambia.³⁵ Obstetric and gynaecologic emergencies, such as complicated delivery or post-partum haemorrhage, lead to high maternal mortality rates in Zambia,^{35 49} but they were not seen by EFARs in our study. The reasons behind this are unknown: it may suggest that existing systems to handle obstetric and gynaecologic emergencies in the Kasama region are adequate, but could equally be due to EFARs feeling disempowered in such cases and therefore not responding. Similarly, injuries accounted for nearly 40% of EFAR chief complaints and reviewers are likely intimately aware of the local burden of injury.^{50 51} Trauma care reflected this, ranking consistently high in mapping and blueprinting. Yet, injury was deemphasised in the final curriculum. A likely explanation for this is that trauma care was actually overrepresented in the original EFAR curriculum due to the extremely large burden of trauma in South Africa in comparison to Zambia.^{4 50 52 53} Further work is required to explore the mismatch in both fields.

Introduction and scene management saw a 242% increase in learning time. In the context of the EFAR programme's main goal – training laypeople to handle the emergencies at a basic level – this result can be seen as successful. EFARs should be spending more time focusing on introductory material that will help them to handle a variety of emergencies. These results parallel other layperson responder programmes, which also place emphasis on broad skills that can aid patients presenting with a range of conditions.^{30 34} While environmental emergencies were included in the original curriculum, they were not included in the course programme that was implemented. Therefore, a before-and-after comparison could not be made, and the total time devoted in the original curriculum was denoted as zero. The percentage of total time in the refined curriculum is only around 3%, speaking to why it may not have been included in the first place: local and programmatic experts do not perceive it to be important.

We believe the refined curriculum will be effective in instructing Zambian EFARs, and in preparing them to manage the emergencies they are most likely to face. This study highlights that no two settings are the same: even between South Africa and Zambia, the course breakdown differs significantly. It is important to consider the context at the start, and to reconsider it at scheduled time intervals, as these LMIC regions are rapidly changing. A refinement process such as this should be used to ensure an appropriate and evolved curriculum is in place as any medical education programme expands.

The EFAR programme, and layperson first response systems in general, are cost effective means of reducing morbidity and mortality in LMICs.^{27 54} These short courses must train up people with minimal prior knowledge in a short span - typically one to five days.^{4 34} As such, course time must be maximised. Mapping and blueprinting can be leveraged to ensure that this occurs. Where curriculums exist, it allows updating of the curriculum to ensure it is context-appropriate. Where no curriculum currently exists, programme developers might use these methods instead to generate an initial curriculum.

It has also proven challenging to identify methods that allow for adaption of programmes to other regions, while maintaining low cost. There are few appropriate strategies for designing educational programmes in LMICs and training community members.⁵⁵ Current literature focuses on resource-heavy methods used in high-income countries, but these are unrealistic in LMICs. The curriculum refinement methods we describe are an efficient way of tailoring programmes to local needs, without heavy reliance on data collection and research personnel. Although the method has two stages, it is cost- and time-effective. Adaptations were easily made throughout the process as needed, from the size of the expert group to the definitions of impact and frequency for blueprinting.

Together, the EFAR model and curriculum refinement methods provide a flexible framework for development and expansion of layperson medical education programmes. These community-based programmes are vitally important to LMIC health systems development, and should be prioritised.

There are several limitations in this study. Based on original communications, we anticipated that data would be collected from two sites. One site did not have any data, and the second had significantly fewer PRFs available than predicted. The sample size was sufficient, but additional data would give a clearer picture of the types of chief complaints EFARs are presented with. It is not uncommon to be without sufficient data sets in LMICs,⁶⁻⁸ which supports the importance of utilising methods such as mapping and blueprinting that rely on minimal data in addition to other factors, such as expert knowledge. While this limits transcaivary of curriculum itself across other LMIC regions, it does not decrease limit translatability of our conclusion: curriculum mapping and blueprinting are practical methods of refining educational programmes to increase contextual relevancy.

The expert group that conducted curricular reviews was limited in size and nature. While the group included only physicians with significant knowledge about the Zambian context, community members and past EFAR trainees, who may have a different expectation of the scope of the EFAR course, were not engaged. Laypersons would likely need to be included in future studies through a simpler process, such as focus groups; however, current literature provides minimal guidance on how to incorporate this qualitative data into a weighted curriculum.

Additionally, the study only included quantitative data. Written commentary collected from reviewers was not incorporated. As such, potentially useful and nuanced comments were not factored into the final weightings of the curriculum. In future iterations, developers should consider methodology that allows for the consideration of various sources of qualitative data in generating the final curriculum.

Results of the study are informing an improved curriculum, to be introduced in-country alongside improved monitoring and evaluation methods later in 2017. Pedagogy for EFAR learners will be

1
2
3 explored during implementation, to ensure that the course content outline in the curriculum is
4 effectively reaching EFAR learners. Ongoing data collection will monitor learning retention, facilitate
5 assessment of EFAR sites, and allow efficient curriculum refinement at scheduled time points in the
6 future.
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ETHICAL CONSIDERATIONS

Ethical approval was obtained by the Human Research Ethics Committees at both the University of Cape Town and the University of Zambia.

FUNDING

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

COMPETING INTERESTS

All authors have completed the ICMJE uniform disclosure form and declare: no support from any organisation for the submitted work; no financial relationships with any organisations that might have an interest in the submitted work in the previous three years; no other relationships or activities that could appear to have influenced the submitted work.

DATA SHARING STATEMENT

No additional data are available.

CONTRIBUTORSHIP

JLP, MK, CC, and LAW conceived the study and contributed to its design. JLP carried out data collection and analysis, and drafted the manuscript. All authors contributed to the manuscript's revision and approved the final version for submission.

ACKNOWLEDGEMENTS

The research team would like to thank the expert review group for their efforts. We would also like to extend our gratitude to Dr Heike Geduld, without whose insight into curriculum development, this project would not have been possible.

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Online Supplement 1: Results of curriculum mapping for topics.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for the Introduction & Scene Management module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management			
	The need for first aid training	History of emergency care & Zambian first aid	Zambian healthcare levels & referral system	Definition of an emergency
Chest pain (2)	5	5	1	5
Hypo/hyperglycaemia (5)	5	5	1	5
Diarrhoea/constipation (2)	5	5	1	5
Nausea/vomiting (1)	5	5	1	5
Abdominal pain/distention (1)	5	5	1	5
Suspected malaria (2)	5	5	1	5
Intoxication (2)	5	5	1	5
Loss of consciousness/fainting (3)	5	5	1	5
Seizure/convulsion (11)	5	5	1	5
Extremity pain (1)	5	5	1	5
Asthma/wheezing (9)	5	5	1	5
Cough (2)	5	5	1	5
Difficulty in breathing (2)	5	5	1	4
Foreign body airway obstruction (8)	0	0	1	0
Dehydration (5)	5	5	1	5
HIV complication (1)	5	5	1	5
Suspected anaemia (2)	5	5	1	5
Swelling (1)	5	5	1	5
Bee sting	5	5	1	5
Back injury	5	5	1	5
Bleeding (27)	5	5	1	5
Burn (1)	5	5	1	5
Chest injury	5	5	1	5
Extremity injury (2)	5	5	1	5
Head or neck injury (3)	5	5	1	5
Injury (unspecified) (3)	0	0	1	0
Open wound (2)	0	0	1	0
Road traffic accident (2)	0	0	1	0
Dislocation injury (1)	0	0	1	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Principles of first aid	Limitations of first aid	Responsibilities & aims	Qualities of first aid
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	0	0	0	5
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)				
	Socrates & doing harm	Good Samaritan law/Legal protection of EFARs	Definition of negligence	Patient abandonment	Patient consent
Chest pain (2)	5	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5	5
Nausea/vomiting (1)	5	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5	5
Suspected malaria (2)	5	5	5	5	5
Intoxication (2)	5	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5	5
Seizure/convulsion (11)	5	5	5	5	5
Extremity pain (1)	5	5	5	5	5
Asthma/wheezing (9)	5	5	5	5	5
Cough (2)	5	5	5	5	5
Difficulty in breathing (2)	5	5	5	5	5
Foreign body airway obstruction (8)	0	1	0	0	0
Dehydration (5)	5	5	5	5	5
HIV complication (1)	5	5	5	5	5
Suspected anaemia (2)	5	5	5	5	5
Swelling (1)	5	5	5	5	5
Bee sting	5	5	5	5	5
Back injury	5	5	5	5	5
Bleeding (27)	5	5	5	5	5
Burn (1)	5	5	5	5	5
Chest injury	5	5	5	5	5
Extremity injury (2)	5	5	5	5	5
Head or neck injury (3)	5	5	5	5	5
Injury (unspecified) (3)	0	0	0	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	0	0	0	0	0
Dislocation injury (1)	0	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Hospital hand-over	Police reporting	Documentation & reporting	Religion, culture & tradition
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	0	0	0	0
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)		
	Calling for help	Scene size-up	Scene safety & PPE
Chest pain (2)	5	5	5
Hypo/hyperglycaemia (5)	5	5	5
Diarrhoea/constipation (2)	5	5	5
Nausea/vomiting (1)	5	5	5
Abdominal pain/distention (1)	5	5	5
Suspected malaria (2)	5	5	5
Intoxication (2)	5	5	5
Loss of consciousness/fainting (3)	5	5	5
Seizure/convulsion (11)	5	5	5
Extremity pain (1)	5	5	5
Asthma/wheezing (9)	5	5	5
Cough (2)	5	5	5
Difficulty in breathing (2)	5	5	5
Foreign body airway obstruction (8)	0	0	0
Dehydration (5)	5	5	5
HIV complication (1)	5	5	5
Suspected anaemia (2)	5	5	5
Swelling (1)	5	5	5
Bee sting	5	5	5
Back injury	5	5	5
Bleeding (27)	5	5	5
Burn (1)	5	5	5
Chest injury	5	5	5
Extremity injury (2)	5	5	5
Head or neck injury (3)	5	5	5
Injury (unspecified) (3)	0	0	0
Open wound (2)	0	0	0
Road traffic accident (2)	0	0	0
Dislocation injury (1)	0	0	0

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Communication	Airway	Breathing	Circulation
Chest pain (2)	5	5	5	5
Hypo/hyperglycaemia (5)	5	5	5	5
Diarrhoea/constipation (2)	5	5	5	5
Nausea/vomiting (1)	5	5	5	5
Abdominal pain/distention (1)	5	5	5	5
Suspected malaria (2)	5	5	5	5
Intoxication (2)	5	5	5	5
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	5	5
Cough (2)	5	5	5	5
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	4	4	4	4
Dehydration (5)	5	5	5	5
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	5	5	5	5
Bee sting	5	5	5	5
Back injury	5	5	5	5
Bleeding (27)	5	5	5	5
Burn (1)	5	5	5	5
Chest injury	5	5	5	5
Extremity injury (2)	5	5	5	5
Head or neck injury (3)	5	5	5	5
Injury (unspecified) (3)	4	5	5	5
Open wound (2)	5	5	0	0
Road traffic accident (2)	5	5	0	5
Dislocation injury (1)	5	5	5	5

Table 1 (cont.): Results of curriculum mapping for the Introduction & Scene Management module.
Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Introduction & Scene Management (cont.)			
	Disability & exposure	Reassessment	Infection prevention	MCIs ¹
Chest pain (2)	5	5	0	1
Hypo/hyperglycaemia (5)	4	5	0	1
Diarrhoea/constipation (2)	5	5	1	1
Nausea/vomiting (1)	4	5	1	1
Abdominal pain/distention (1)	5	5	0	1
Suspected malaria (2)	4	5	1	1
Intoxication (2)	5	5	0	1
Loss of consciousness/fainting (3)	4	5	0	1
Seizure/convulsion (11)	5	5	0	1
Extremity pain (1)	4	5	0	1
Asthma/wheezing (9)	5	5	1	1
Cough (2)	4	5	1	1
Difficulty in breathing (2)	5	5	1	1
Foreign body airway obstruction (8)	4	4	0	1
Dehydration (5)	5	5	0	1
HIV complication (1)	4	5	1	1
Suspected anaemia (2)	5	5	1	1
Swelling (1)	4	5	0	1
Bee sting	5	5	0	1
Back injury	4	5	0	1
Bleeding (27)	5	5	1	1
Burn (1)	4	5	0	1
Chest injury	5	5	0	1
Extremity injury (2)	4	5	0	1
Head or neck injury (3)	5	5	0	1
Injury (unspecified) (3)	4	5	0	1
Open wound (2)	0	5	1	1
Road traffic accident (2)	4	5	0	1
Dislocation injury (1)	4	5	1	1

¹ MCI: Mass casualty incident

Table 2: Results of curriculum mapping for the Injuries module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Injuries					
	Approach to patient	First aid for common sports injuries	Head & spinal injuries	Bleeding	Fractures & soft tissue injuries	Burns
Chest pain (2)	5	0	5	5	5	0
Hypo/hyperglycaemia (5)	5	0	5	5	5	0
Diarrhoea/constipation (2)	5	0	5	5	5	0
Nausea/vomiting (1)	5	0	5	5	5	0
Abdominal pain/distention (1)	5	0	5	5	5	0
Suspected malaria (2)	5	0	5	5	5	0
Intoxication (2)	5	0	5	5	5	0
Loss of consciousness/fainting (3)	5	0	5	5	5	0
Seizure/convulsion (11)	5	0	5	5	5	0
Extremity pain (1)	5	0	5	5	5	0
Asthma/wheezing (9)	5	0	5	5	5	0
Cough (2)	5	0	5	5	5	0
Difficulty in breathing (2)	5	0	5	5	5	0
Foreign body airway obstruction (8)	4	0	4	4	4	0
Dehydration (5)	5	0	5	5	5	0
HIV complication (1)	5	0	5	5	5	0
Suspected anaemia (2)	5	0	5	5	5	0
Swelling (1)	5	0	5	5	5	0
Bee sting	5	0	5	5	5	0
Back injury	5	1	5	5	5	0
Bleeding (27)	5	1	5	5	5	0
Burn (1)	5	1	5	5	5	0
Chest injury	5	1	5	5	5	0
Extremity injury (2)	5	1	5	5	5	0
Head or neck injury (3)	5	1	5	5	5	0
Injury (unspecified) (3)	5	1	5	5	5	0
Open wound (2)	5	1	0	5	0	0
Road traffic accident (2)	5	0	5	5	0	0
Dislocation injury (1)	5	1	5	5	5	0

Table 3: Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies				
	Unconscious- ness	Stroke	Seizures	Fever	Hypo- glycaemia
Chest pain (2)	0	0	0	0	0
Hypo/hyperglycaemia (5)	5	2	5	0	5
Diarrhoea/constipation (2)	0	0	0	5	0
Nausea/vomiting (1)	0	1	0	5	0
Abdominal pain/distention (1)	0	0	0	5	0
Suspected malaria (2)	0	0	1	5	0
Intoxication (2)	5	1	5	0	5
Loss of consciousness/fainting (3)	5	5	5	1	5
Seizure/convulsion (11)	5	2	5	5	5
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	0
Cough (2)	0	0	0	5	0
Difficulty in breathing (2)	0	0	0	5	0
Foreign body airway obstruction (8)	4	0	0	0	0
Dehydration (5)	0	0	0	0	0
HIV complication (1)	0	0	0	1	0
Suspected anaemia (2)	0	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding (27)	5	0	0	0	0
Burn (1)	0	0	0	0	0
Chest injury	0	0	0	0	0
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	0	0	0	0	0
Injury (unspecified) (3)	0	0	0	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	1	0	0	1	1
Dislocation injury (1)	0	0	0	0	0

Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies (cont.)				
	Dehydration	Drug & substance abuse & psychosis	Poisoning	Anaphylaxis	Difficulty breathing
Chest pain (2)	0	0	0	0	1
Hypo/hyperglycaemia (5)	0	0	0	0	0
Diarrhoea/constipation (2)	5	1	1	0	0
Nausea/vomiting (1)	5	1	1	0	0
Abdominal pain/distention (1)	0	1	1	0	0
Suspected malaria (2)	0	0	0	0	0
Intoxication (2)	5	5	5	0	5
Loss of consciousness/fainting (3)	5	1	1	0	5
Seizure/convulsion (11)	5	0	1	0	5
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	5
Cough (2)	0	0	0	0	5
Difficulty in breathing (2)	0	0	0	0	5
Foreign body airway obstruction (8)	0	0	0	0	5
Dehydration (5)	5	0	0	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	0	0	0	0	1
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	1	0
Back injury	0	0	0	0	0
Bleeding (27)	4	0	0	0	0
Burn (1)	5	0	0	0	0
Chest injury	0	0	0	0	1
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	0	0	0	0	0
Injury (unspecified) (3)	4	0	0	0	0
Open wound (2)	4	0	0	0	0
Road traffic accident (2)	4	0	0	0	1
Dislocation injury (1)	4	0	0	0	0

Table 3 (cont.): Results of curriculum mapping for the Medical Emergencies module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Medical Emergencies (cont.)				
	Headache	Chest pain	Abdominal pain	Extremity pain	Generalised pain
Chest pain (2)	0	5	0	0	0
Hypo/hyperglycaemia (5)	5	0	0	0	0
Diarrhoea/constipation (2)	0	0	5	0	0
Nausea/vomiting (1)	1	1	5	0	0
Abdominal pain/distention (1)	0	0	5	0	0
Suspected malaria (2)	5	0	0	0	0
Intoxication (2)	5	0	5	0	0
Loss of consciousness/fainting (3)	1	1	0	0	0
Seizure/convulsion (11)	1	0	0	0	0
Extremity pain (1)	0	0	0	5	5
Asthma/wheezing (9)	0	5	0	0	0
Cough (2)	0	5	0	0	0
Difficulty in breathing (2)	0	5	0	0	0
Foreign body airway obstruction (8)	0	0	0	0	0
Dehydration (5)	1	0	5	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	5	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	0	0
Bleeding (27)	0	0	0	0	0
Burn (1)	0	0	0	0	0
Chest injury	0	5	0	0	0
Extremity injury (2)	0	0	0	0	0
Head or neck injury (3)	5	0	0	0	0
Injury (unspecified) (3)	1	1	1	0	0
Open wound (2)	0	0	0	0	0
Road traffic accident (2)	2	1	1	0	0
Dislocation injury (1)	0	0	0	0	0

Table 4: Results of curriculum mapping for the Obstetrics & Gynaecology module. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Obstetric & Gynaecology
Chest pain (2)	0
Hypo/hyperglycaemia (5)	0
Diarrhoea/constipation (2)	0
Nausea/vomiting (1)	0
Abdominal pain/distention (1)	3
Suspected malaria (2)	0
Intoxication (2)	0
Loss of consciousness/fainting (3)	1
Seizure/convulsion (11)	0
Extremity pain (1)	0
Asthma/wheezing (9)	0
Cough (2)	0
Difficulty in breathing (2)	0
Foreign body airway obstruction (8)	0
Dehydration (5)	0
HIV complication (1)	0
Suspected anaemia (2)	0
Swelling (1)	0
Bee sting	0
Back injury	0
Bleeding (27)	5
Burn (1)	0
Chest injury	0
Extremity injury (2)	0
Head or neck injury (3)	0
Injury (unspecified) (3)	0
Open wound (2)	0
Road traffic accident (2)	0
Dislocation injury (1)	0

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Table 5: Results of curriculum mapping for the Environmental Emergencies section. Frequency of chief complaint in Kasama EFAR data is denoted by “n”.

Topic Chief complaint (n)	Environmental Emergencies			
	Bites & stings	Electrocution	Lightning	Drowning
Chest pain (2)	0	1	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	0	0	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	0	0	0	0
Suspected malaria (2)	0	0	0	0
Intoxication (2)	0	0	0	0
Loss of consciousness/fainting (3)	0	2	2	1
Seizure/convulsion (11)	0	1	2	0
Extremity pain (1)	1	0	1	0
Asthma/wheezing (9)	1	0	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	2	0	0	3
Foreign body airway obstruction (8)	0	0	0	0
Dehydration (5)	0	0	0	0
HIV complication (1)	0	0	0	0
Suspected anaemia (2)	0	0	0	0
Swelling (1)	2	0	0	0
Bee sting	5	0	0	0
Back injury	0	1	1	0
Bleeding (27)	0	0	0	0
Burn (1)	0	2	3	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	1	1	0
Injury (unspecified) (3)	0	1	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	1	0	0

Online Supplement 2: Results of curriculum mapping for skills.

The scores presented here are the summed totals across all reviewers. Scores range from 0 (none of the reviewers found the curricular element important in relation to the complaint) to 5 (all found it important).

Table 1: Results of curriculum mapping for bandaging, fracture stabilisation, BVM¹ use & C-spine stabilisation.

Skill Chief complaint (n)	Bandaging open wounds	Basic fracture stabilisation	BVM use	C-spine stabilisation
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

¹ BVM: Bag-valve mask

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Table 2: Results of curriculum mapping for calling for help, CPR², defibrillation & documentation.

Skill Chief complaint (n)	Calling for help via mobile phone	CPR	Defibrillation	Documentation
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

² CPR: Cardiopulmonary resuscitation

Table 3: Results of curriculum mapping for first aid fundamentals, obtaining consent, airway maintenance & patient extrication.

Skill Chief complaint (n)	Fundamentals of first aid	Obtaining consent	Opening/maint aining airway	Patient extrication
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 4: Results of curriculum mapping for patient transport, primary patient assessment, recovery position & scene size-up.

Skill Chief complaint (n)	Patient transport	Primary patient assessment	Recovery position	Scene size-up
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

Table 5: Results of curriculum mapping for secondary patient assessment, trauma assessment, triage & PPE³ usage.

Skill Chief complaint (n)	Secondary patient assessment	Trauma assessment	Triage	Using PPE
Chest pain (2)	0	0	0	0
Hypo/hyperglycaemia (5)	0	0	0	0
Diarrhoea/constipation (2)	4	4	0	0
Nausea/vomiting (1)	0	0	0	0
Abdominal pain/distention (1)	4	5	5	5
Suspected malaria (2)	5	0	0	0
Intoxication (2)	5	0	0	0
Loss of consciousness/fainting (3)	5	5	5	5
Seizure/convulsion (11)	5	5	5	5
Extremity pain (1)	5	5	5	5
Asthma/wheezing (9)	5	5	0	0
Cough (2)	0	0	0	0
Difficulty in breathing (2)	5	5	5	5
Foreign body airway obstruction (8)	5	5	5	5
Dehydration (5)	0	0	0	0
HIV complication (1)	5	5	5	5
Suspected anaemia (2)	5	5	5	5
Swelling (1)	0	0	0	0
Bee sting	0	0	0	0
Back injury	5	5	5	5
Bleeding (27)	0	0	0	0
Burn (1)	0	0	0	0
Chest injury	0	0	0	0
Extremity injury (2)	0	0	0	0
Head or neck injury (3)	0	0	0	0
Injury (unspecified) (3)	0	0	0	0
Open wound (2)	0	0	0	0
Road traffic accident (2)	0	0	0	0
Dislocation injury (1)	0	0	0	0

³ PPE: Personal protective equipment

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Table 6: Results of curriculum mapping for glucometer use, delivery, malaria rapid testing, log rolling & pre-hospital ECG⁴ use.

Skill Chief complaint (n)	Using a glucometer	Delivery	Malaria rapid test	Log rolling	Pre-hospital ECG
Chest pain (2)	0	0	0	0	0
Hypo/hyperglycaemia (5)	5	0	0	0	0
Diarrhoea/constipation (2)	0	0	0	0	0
Nausea/vomiting (1)	0	0	0	0	0
Abdominal pain/distention (1)	0	0	0	0	0
Suspected malaria (2)	0	0	1	0	0
Intoxication (2)	0	0	0	0	0
Loss of consciousness/fainting (3)	0	0	0	0	0
Seizure/convulsion (11)	0	0	0	0	0
Extremity pain (1)	0	0	0	0	0
Asthma/wheezing (9)	0	0	0	0	0
Cough (2)	0	0	0	0	0
Difficulty in breathing (2)	0	0	0	0	0
Foreign body airway obstruction (8)	0	0	0	0	0
Dehydration (5)	0	0	0	0	0
HIV complication (1)	0	0	0	0	0
Suspected anaemia (2)	0	0	0	0	0
Swelling (1)	0	0	0	0	0
Bee sting	0	0	0	0	0
Back injury	0	0	0	1	0
Bleeding (27)	0	0	0	1	0
Burn (1)	0	0	0	1	0
Chest injury	0	0	0	1	0
Extremity injury (2)	0	0	0	1	0
Head or neck injury (3)	0	0	0	1	0
Injury (unspecified) (3)	0	0	0	1	0
Open wound (2)	0	0	0	1	0
Road traffic accident (2)	0	0	0	1	0
Dislocation injury (1)	0	0	0	1	0

⁴ ECG: Electrocardiogram

Online Supplement 3: Results of curriculum blueprinting for topics and subtopics.

Curriculum topic(s)	Curriculum sub-topics	Impact	Frequency	I x F	Relative %	Weight	Section weight total
Introduction to emergency care	The need for first aid training	3.00	2.00	6.00	2.25	0.02	0.07
	History of emergency care & Zambian first aid	1.60	1.60	2.56	0.96	0.01	
	Zambian healthcare levels & referral system	2.40	1.80	4.32	1.62	0.02	
	Definition of an emergency	2.40	2.20	5.28	1.98	0.02	
Basic fundamentals of first aid	Principles of first aid	3.00	2.20	6.60	2.47	0.02	0.09
	Limitations of first aid	2.80	2.20	6.16	2.31	0.02	
	Responsibilities & aims	2.60	1.80	4.68	1.75	0.02	
	Qualities of first aid	2.60	2.20	5.72	2.14	0.02	
Medical-legal aspects of care	Socrates & doing harm	2.40	2.00	4.80	1.80	0.02	0.08
	Good Samaritan law/legal protection of EFARs ¹	2.40	2.00	4.80	1.80	0.02	
	Definition of negligence	2.00	1.40	2.80	1.05	0.01	
	Patient abandonment	2.00	1.80	3.60	1.35	0.01	
	Patient consent	2.20	2.00	4.40	1.65	0.02	
Procedures & implications of providing care	Hospital hand-over	2.00	1.40	2.80	1.05	0.01	0.02
	Police reporting	1.20	1.40	1.68	0.63	0.01	
	Documentation & reporting	1.40	1.40	1.96	0.73	0.01	
Religion, culture & tradition		0.50	0.33	0.17	0.06	0.00	0.00
Assessing the scene	Calling for help	2.60	2.40	6.24	2.34	0.02	0.06
	Scene size-up	2.60	2.00	5.20	1.95	0.02	
	Scene safety & PPE ²	2.60	2.00	5.20	1.95	0.02	
Patient primary assessment	Communication	2.40	2.00	4.80	1.80	0.02	0.09
	Airway	3.00	2.20	6.60	2.47	0.02	
	Breathing	3.00	2.20	6.60	2.47	0.02	

¹ EFAR: Emergency first aid responder² PPE: Personal protective equipment

	Circulation	2.80	2.20	6.16	2.31	0.02	
Patient secondary assessment	Disability & exposure	2.80	1.80	5.04	1.89	0.02	0.04
	Reassessment	2.40	2.60	6.24	2.34	0.02	
Trauma	Approach to patient	2.80	2.40	6.72	2.52	0.03	0.14
	First aid for common sports injuries	2.60	2.20	5.72	2.14	0.02	
	Head & spinal injuries	2.60	1.80	4.68	1.75	0.02	
	Bleeding	2.80	3.00	8.40	3.15	0.03	
	Fractures & soft tissue injuries	2.40	2.60	6.24	2.34	0.02	
	Burns	2.60	2.20	5.72	2.14	0.02	
Unconsciousness		3.00	2.60	7.80	2.92	0.03	0.03
Stroke		2.40	1.80	4.32	1.62	0.02	0.02
Seizures		2.80	2.40	6.72	2.52	0.03	0.03
Fever		2.80	3.00	8.40	3.15	0.03	0.03
Hypoglycaemia		2.80	2.60	7.28	2.73	0.03	0.03
Dehydration		2.80	3.00	8.40	3.15	0.03	0.03
Drug & substance abuse & psychosis		2.00	1.40	2.80	1.05	0.01	0.01
Poisoning		2.20	1.40	3.08	1.15	0.01	0.01
Anaphylaxis		2.60	1.40	3.64	1.36	0.01	0.01
Breathing difficulties		2.60	2.60	6.76	2.53	0.03	0.03
Severe pain	Headache	2.20	2.40	5.28	1.98	0.02	0.09
	Chest pain	2.60	2.20	5.72	2.14	0.02	
	Abdominal pain	2.60	2.40	6.24	2.34	0.02	
	Extremity pain	1.75	1.75	3.06	1.15	0.01	
	Generalised pain	1.80	1.60	2.88	1.08	0.01	
Obstetric & gynaecological emergencies		2.25	1.25	2.81	1.05	0.01	0.01
Environmental emergencies	Bites & stings	2.00	1.80	3.60	1.35	0.01	0.05
	Electrocution	2.60	1.20	3.12	1.17	0.01	
	Lightning	1.80	1.20	2.16	0.81	0.01	
	Drowning	2.40	1.40	3.36	1.26	0.01	
Mass casualty incidents		2.80	1.60	4.48	1.68	0.02	0.02
Infection prevention		2.80	2.60	7.28	2.73	0.03	0.03

Online Supplement 4: Results of curriculum blueprinting for skills.

Skills	Impact	Frequency	I x F	Relative %	Weight
Defibrillation	1.60	0.75	1.20	1.09	0.01
Documentation	1.60	1.25	2.00	1.81	0.02
CPR ¹	2.20	1.00	2.20	2.00	0.02
Pre-hospital ECG ²	2.40	1.00	2.40	2.18	0.02
Malaria rapid test	1.80	1.50	2.70	2.45	0.02
BVM ³ use	2.40	1.25	3.00	2.72	0.03
Delivery	2.40	1.50	3.60	3.27	0.03
Using a glucometer	2.40	1.50	3.60	3.27	0.03
Obtaining consent	2.20	1.75	3.85	3.49	0.03
Secondary patient assessment	2.20	1.75	3.85	3.49	0.03
Log rolling	2.40	1.75	4.20	3.81	0.04
Using PPE ⁴	2.20	2.00	4.40	3.99	0.04
Patient extrication	2.60	1.75	4.55	4.13	0.04
Triage	2.60	1.75	4.55	4.13	0.04
Basic fracture stabilisation	2.40	2.00	4.80	4.35	0.04
C-spine stabilisation	2.80	1.75	4.90	4.44	0.04
Scene size-up	2.40	2.25	5.40	4.90	0.05
Fundamentals of first aid	2.80	2.00	5.60	5.08	0.05
Patient transport	2.80	2.00	5.60	5.08	0.05
Recovery position	2.60	2.25	5.85	5.31	0.05
Opening/maintaining airway	3.00	2.00	6.00	5.44	0.05
Bandaging open wounds	2.60	2.50	6.50	5.90	0.06
Calling for help via mobile phone	2.60	2.50	6.50	5.90	0.06
Primary patient assessment	2.60	2.50	6.50	5.90	0.06
Trauma assessment	2.60	2.50	6.50	5.90	0.06

¹ CPR: Cardiopulmonary resuscitation² ECG: Electrocardiogram³ BVM: Bag-valve mask⁴ PPE: Personal protective equipment